TAMPEREEN TEKNILLINEN YLIOPISTO
TAMPERE UNIVERSITY OF TECHNOLOGY

EEVA ANDREJEFF

DESIGNING A PERSUASIVE MOBILE APPLICATION CONCEPT FOR WALKING MEETINGS

Master of Science thesis

Examiners: prof. Kaisa Väänänen & PhD Aino Ahtinen
Examiners and topic approved by the Faculty Council of the Faculty of Computing and Electrical Engineering on 28th February 2018

ABSTRACT

EEVA ANDREJEFF: Designing a persuasive mobile application for walking meetings
Tampere University of technology
Master of Science Thesis, 59 pages, 4 Appendix pages
May 2018
Master's Degree Programme in Information Technology
Major: User Experience
Examiner: Professor Kaisa Väänänen & PhD Aino Ahtinen

Keywords: User experience, mobile application, walking meeting, persuasion, persuasive design

During the last few decades our lives have become more and more sedentary in the same phase as the technology has improved and become increasingly pervasive. Not so long ago both our work life and free time has been much more physically demanding whereas nowadays we must make conscious effort to have enough exercise. As physical inactivity is not beneficial either to our physical health or mental capacity, we need solutions that allow us to step away from our computers and have some time having some physical activity.

The aim of this thesis is to design a mobile application concept that gives us the right kind of tools and motivational elements to help people find the ways to apply walking meetings in their working days. There are already multiple different physical activity trackers for mobile platforms, but nearly all of them are designed for individual sports tracking or overall daily activity tracking in the free time. As this application is aimed for the workplace context and to support the knowledge work while it is also persuading people to be physically more active, a regular activity tracker will not have the right kind of features to support the walking meetings in their entirety. This work presents how a workplace context differs from free time context when designing a physical activity tool and what kind of allowances and restrictions it sets. Another important part of the work is to show what kind of practical features and motivational features users expect and need from a walking meeting application in the working context.

The theoretical frame of the work forms around the user interface design, Human-centered design process, motivation and Self-Determination Theory as well as Persuasive design. This knowledge is combined with three user studies that were done as a part of a research project. The three studies consist of a background study that collects the possible users' initial ideas and expectations for the application, a Walking metro prototype study where people got to try the first prototype, and a four-week Brainwolk pilot study where people got to freely use the walking meeting application as a part of their daily work. The studies form a picture about the users' needs and the context of use where theoretical framework provides information about other areas related to the walking meeting application design.

Finally, this work presents design guidelines for physical activity tools in the workplace context and a walking meeting application concept that is based on the presented guidelines as well as other results presented in this work. The goal is to provide reusable guidelines that can be applied also other work related physical activity applications and also provide concrete examples how a persuasive walking meeting application would work in practice.

TIIVISTELMÄ

EEVA ANDREJEFF: Suostuttelevaa suunnittelua hyödyntävän kävelytapaamissovelluskonseptin suunnittelu
Tampereen teknillinen yliopisto
Diplomityö, 59 sivua, 4 liitesivua
Toukokuu 2018
Tietotekniikan diplomi-insinöörin tutkinto-ohjelma
Pääaine: User Experience
Tarkastaja: professori Kaisa Väänänen & filosofian tohtori Aino Ahtinen

Avainsanat: Käyttäjäkokemus, mobiilisovellus, kävelytapaaminen, suostutteleva suunnittelu

Viimeisten vuosikymmenten aikana elämäntapamme ovat muuttuneet koko ajan vähemmän ja vähemmän liikkuvaan suuntaan samalla kun teknologia on kehittynyt erottamattomaksi osaksi jokapäiväistä elämäämme. Siinä missä vielä joitakin vuosikymmeniä sitten sekä työelämämme että vapaa-aikamme kului paljon nykyistä enemmän fyysisesti vaativien tehtävien parissa, nykypäivä meidän on puolestaan tehtävä tietoisesti töitä, jotta liikkuisimme tarpeeksi. Liian vähäinen liikunta ei ole hyväksi fyysiselle kunnollemme, mutta ei myöskään mielellemme, ja me siksi tarvitsemme erilaisia ratkaisuja, jotka auttavat meitä astumaan pois tietokoneelta ja viettämään aikaan liikkumisen parissa.

Tämän työn tavoitteena on suunnitella mobiilisovellus, joka tarjoaa käyttäjilleen oikeanlaiset työkalut ja motivoivat ominaisuudet, jotka auttavat ihmisiä ottamaan kävelytapaamiset osaksi työrutiinejaan. Vaikka erilaisia aktiivisuusmittareita on olemassa jo useita erilaisia, niistä lähes kaikki on suunniteltu yksittäisten urheilusuoritusten mittaamiseen tai päivittäisen kokonaisaktiivisuuden mittaamiseen. Koska tämä applikaatio on suunnattu työympäristöön tietotyötä tekeville ihmisille ja suostuttelemaan heitä liikkumaan enemmän työpäivän aikana, tavallinen aktiivisuusmittari ei tarjoa kaikkia tarvittavia ominaisuuksia tukemaan kävelytapaamisten tekemistä työajalla. Tämä osaltaan kertoo myös miten työympäristö paikkana vaikuttaa kävelypalaverisovelluksen suunnitteluun, ja millaisia vaatimuksia ja mahdollisuuksia työympäristö paikkana asettaa. Toinen työn tärkeä osa-alue on kertoa millaisia ominaisuuksia ja motivaatioelementtejä käyttäjät odottavat ja tarvitsevat kävelytapaamissovellukselta työympäristössä.

Työn teoreettinen osuus koostuu käyttöliittymäsuunnittelun ja Ihmiskeskeisen suunnittelu prosessin esittelystä sekä motivaation, Itseohjautuvuusteorian ja suostuttelevan suunnittelun esittelyistä. Nämä tiedot yhdistettynä tutkimusprojektissa tehtyjen kolmen käyttäjätutkimuksen tulosten kanssa muodostavat työn varsinaisen pohjan. Tutkimuksessa tehdyt käyttäjätutkimukset ovat taustatutkimus, Kävelymetro prototyyppitutkimus ja neljän viikon Bainwolk pilottitutkimus, jossa osallistujat käyttivät applikaatiota itsenäisesti osana työtään. Tutkimukset muodostavat kokonaiskuvan käyttäjien tarpeista ja käyttökontekstista, kun taas työssä esitetty teoriaosuus tarjoaa tietoa erilaisista sovelluksen suunnittelutyöhön liittyvistä näkökulmista.

Lopuksi tämä työ esittelee suunnitteluohjeet työympäristöön suunniteltaville fyysiseen aktiivisuuteen motivoivan sovelluksen suunnitteluun sekä kävelytapaamissovelluskonseptin, joka pohjautuu sekä suunnitteluohjeisiin sekä muihin työssä esitettyihin tuloksiin ja tietoihin. Tavoitteena on tuottaa suunnitteluohjeet, jotka ovat sovellettavissa myös muihin kuin kävelytapaamisapplikaation suunnitteluun ja esittää konkreettisia esimerkkejä miten suostutteleva kävelytapaamissovellus toimisi käytännössä.

PREFACE

For a person who struggles to find motivation to keep up physically active life style it has been an interesting and educational journey to do the research, studies and design for this thesis. As the work has progressed, I have also personally learned new ways to feel motivated and started to find new ways to motivate myself to live more healthy and active life.

I want to thank Aino Ahtinen for letting me work with her in her study through the POP UP project and for providing me support and feedback as a supervisor through the thesis process. I also want to thank my other supervisor Kaisa Väänänen for all the feedback and support during the thesis process, especially when it was the time to wrap up the work and graduate.

Final thanks to my husband Antti who always reminded me to have balance between the work and play.

It has been a long walk with multiple meetings but finally I am stepping over the finish line.

Helsinki, 16.05.2018

Eeva Andrejeff

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LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

GPS	Global Positioning System
GUI	Graphical user interface
HCD	Human-Centered Design
HCI	Human-Computer Interaction
SDT	Self-Determination Theory
UI	User interface
UX	User experience
WIMP	Windows, Icons, Menus, Pointer

1. INTRODUCTION

Our lives have become more and more sedentary during the recent decades. Both our work and free time involve more and more "activities" that don't require any physical activity from us. We are becoming more and more conscious about the fact that we must change our habits to have a better future, but changing habits, at least the once that are easy and comfortable, is not always easy.

The goal of this thesis is to present a walking meeting application concept and design guidelines that are the final iteration of Brainwolk concept that was based on three user studies that were conducted as a part of POP UP -project studying the area of Liikuttavat työtavat funded by Tekes. The project was about studying different ways to support work by creating different work spaces or by trying to change the ways we do work, and the project was active from January 2015 to April 2017. In our research we study how to support walking meetings with a mobile application. To understand the big picture, we first take a few steps back and build a picture of how we work, how it affects us and how we can persuade the change. This mobile application is one way to offer knowledge workers a tool and allowance to step away from the computers from time to time during working hours.

1.1 Background and Motivation

If we think about our current way of working, or at least work in knowledge work positions, we soon notice that our way of working is very sedentary. Most of our days pass by sitting in front of computers, in meeting rooms, or in the car or bus. On the other hand, we constantly hear nagging about our way to work – it is unhealthy, our bodies were not built to sit for hours and hours.

According some studies we may sit half of our work day (Jans et al., 2007) or even more, and that is very much the reality at least for knowledge workers. As much as we may enjoy the sedentary life, we cannot deny our decreasing physical fitness also affect to our physical health. For example, there has been found relations between sedentary lifestyle and type 2 diabetes in two studies (Hu FB et al. 2001 & 2003) and also relations to mortality from cardio vascular disease and all causes in one study (Katzmarzyk, P. et al, 2009) in recent years. By sitting we will develop many kinds of health issues, our muscles and spine suffer from sitting, and having an exercise or two in a week after work will not help us balance the load that sitting is creating in our bodies. It is not a pretty or very motivating picture.

One solution to the problem is to sit less at work and to stand up. There are multiple different devices, special furniture and tools that allow us to ignore our office chair and stand up in front of computer, or even move or stretch a little. Also, the wellness applications and activity trackers are booming right now offering us a way to keep

on track our movement. But the fact remains that we are still afraid to step away from our computers, probably because the picture of efficient worker in our minds is a worker who sits in front of computer constantly tapping the keyboard. And after all, we are quite comfortable sitting in front of our computers. We have email, various chat tools, internet full of knowledge and if we really need to talk someone, we can use a phone. There is no need to leave the chair. And what our bosses would think if we did?

In this work the problem of not being physically active enough at work is approach by designing a walking meeting application. Walking meeting applications is a smart phone based tool that provides advice, motivation and support to do walking meetings while working. The walking meeting application takes overall a bit different angle to this sitting problem. The basic idea behind the application is about leaving our computers, desks and chairs behind and having a short but refreshing walk by ourselves or with our colleague or co-worker while handling work related topics. The walking itself isn't a novel idea, but offering a platform that gives users tips, data, planning tools, encouragement and social features to take these walks can be the way to enable knowledge workers to get the experience of walking and motivate us to walk.

To take a walk you don't need any special equipment and walking has many health benefits, both physical and mental. Our studies as well as other's studies show that walking influences wellbeing, creativity, cognitive capabilities and social factors. In the light of health-related studies, it would be very beneficial to mold our working culture and mental image of efficient and healthy knowledge worker towards more physically active employees. Even if the walking meeting application will not solve all the problems related to this matter, it can serve as enabling and motivating tool in the process of change and persuade workers to try and adopt a new way to work.

This work focuses on the features and general guidelines that should be taken in account when designing a walking meeting application to the work environment. The wellbeing related data has been presented in other publications and the purpose of this work is to present a concrete concept that combines all the elements and features that the users in our studies experienced to be important parts in the application. The design guidelines can be applied to other similar applications but the nature of the application, the user group and context of use should also be considered when applying these guidelines to other applications.

1.2 Research Objectives and Methodology

In this work the goal is to create a motivating and guiding walking meeting application that supports people starting from beginners to more experienced users who want to use walking meetings as a part of their work. The right kind of set of features and the way of interaction is important to the successful walking meeting experience, and keeping up the motivation to continue using walking meetings as a way of work.

In this work I aim to answer following research questions:

> RQ 1: What makes a walking meeting application different from other physical activity mobile applications?
>
> RQ 2: What kind of features and functionalities support and motivate users in a walking meeting application?

The biggest challenges to the applications design sets the working place as a context of use as well as the dividing the attention between walking, talking and utilizing the application while doing a walking meeting. The three studies on the other hand provided information how to overcome these challenges and gave an good idea what kind of features and tools the application should include. These results also reveal the answers for the research questions above.

1.3 Structure of the Thesis

In the following chapter the basics of user interface design is presented from the perspective of user experience design. In the third chapter the motivational design and persuasive design are explained. In chapter 4 I will tell you about the studies and results we concluded in POP UP project and how they affect my design and what kind of differences we uncovered in comparison to the average well-being applications that people use in their free time. The design guidelines are presented in the chapter 5 and the chapter 6 is about the concept design and what kind of features and design solutions the application includes. Finally, the chapter 7 will offer the discussion and conclusions of the whole work.

2. USER INTERFACES AND USER INTERFACE DESIGN

As the aim of this work is to create an ideal user interface for walking meeting purposes using a smart phone platform it is important to understand better what kind of requirements a mobile platform sets for the user interface design. In this chapter will be explained what is a user interface, and what elements the user interface and the user interface design consist of. The chapter also covers special requirements of mobile and smartphone platforms for the user interface design and how the designs can be evaluated.

2.1 User interfaces

In general, a user interface is the part of the system or product that user will use to interact with the system, e.g. pressing buttons on smartphone touch screen or using a keyboard on computer. In other words, it is the visible and physical part of the system and it enables the interaction with the system by utilizing different senses and interaction techniques. The interaction with the system using user interface consists of inputs from the user operates the system by using controlling software via physical device and the system gives feedback for the user in the form of some sort of output (Oulasvirta, 2011).

In a more concrete level user interfaces in digital products consist of windows, title bars, screen splitters, boxes, and manipulative elements like hyperlinks, dropdowns, buttons, sliders, menus, etc. These elements allow us to select and modify objects and they visually communicate us what we can do with the user interface we have in hand. (Cooper, 2014). In modern systems the interaction and manipulation with a user interface is also in many cases multimodal. Multimodal interaction means that the system processes combined natural input modes, like speech, pen, touch, hand gestures, eye gaze, and head and body movements, and provides coordinated multimedia output (Oviatt, 1999). For example, when a user types a message to a chat using a smart phone. In this case the user gives the input for the system using a virtual keyboard on the smart phone screen. The letter that user taps on the screen are the input for the system and as the output the user will see the letters appearing on the screen and, as the smartphone does not have physical buttons, it is also possible to give haptic feedback for each pressed letter as well.

There are also a multiple different types of user interfaces. The earliest computer based user interfaces were command-based systems that required users to type in the commands that they wanted a system to perform. As this kind of interaction was too complex for most of the users, soon followed the WIMP (windows, icons, menus, pointer) and Graphical User Interface (GUI) systems that are built by using windows, icons, menus and some kind of pointing device to make the interaction easier and more visual. Most of the past and current computers utilize some kind of GUIs in their operating systems. Other interface types that followed the WIMPs and GUIs are for example web interfaces, mobile interfaces, multimodal interfaces, air-based gesture

interfaces, mobile interfaces, augmented reality interfaces, and virtual reality interfaces. (Rogers, Y. et al., 2011) Most of the basic user interface design rules apply to these interfaces but all of them also have some specific rules and guidelines that apply to the specific platform or environment.

2.1.1 Mobile user interfaces

Mobile phones have been part of our everyday life since the early 1990s. The first mobile phones served the need of making and receiving calls on the go, and looking back it was very hard to even imagine the current smart phones that have replaced the need of calling by fulfilling many other needs – such as taking photos and videos, having an easy access to internet, keeping in touch with friends with multiple social media applications, and playing games anywhere you go. The mobile phones also have some specific differences in comparison to other computing devices.

Based on the literacy, the most important differences in comparison to an average pc are most likely:

1) the mobility of the device
2) the small screen sizes
3) the touch screen interaction

The book Interaction design: beyond human-computer interaction 3rd edition (Rogers et al., 2011) points out the size and the portability of the mobile devices in terms of them becoming a pervasive part of our lives during the last few decades. At the time the 3rd edition of the book came out, the touch screens were still seen as somewhat new thing, but Rogers et al. also pointed out that touch screen are becoming an important part of interaction in the mix with physical buttons. Now touch screens have become popular not only in smartphones and tablets but also on laptops and hand-held game consoles like Nintendo Switch.

These three points also are highlighted in the Jun Gong's paper *"Guidelines for hand held device interaction design in the list of additional guidelines to Shneiderman's Eight golden rules".* For example, Gong list of additional includes guidelines called "Design for multiple and dynamic contexts", Design for small devices", and "Design for 'Top-Down' interaction" (Gong, 2004). Where a table top computer or even a laptop is hard to use when walking around, a smart phone is very easy to use anywhere and it offers most of the functionalities as a regular computer has.

When comparing computer screen and mobile phone screens, a table top or laptop screen usually offers screen sizes from anywhere from 10" even to over 40", smart phone screen sizes vary around 4" to 6" (screensiz.es, 2017). Even if the resolution in both screens are currently around the same, all the way up to the 4K resolution, the higher pixel density in a smaller screen always means that there is physically less space for the user interface. That usually means that where on the larger screen, the ideal way to design is to keep the functionalities visible to the user, on small screens you must consider what are the most essential things that a user wants to have access and what functionalities you can hide. Usually the smaller screen size also

means less text and more icons, in comparison to the pc user interfaces. This is a part where for example platform specific design guidelines can help to make design decisions. Guidelines such as Google Material design (Google, 2017) and Apple Developer design guidelines (Apple, 2017) offer you knowledge how to follow the platform specific conventions and at the same time fit all the functionalities you want on a small screen.

The touch screen interaction is one of the key interactions in the mobile device usage. Even if the speech command functionalities start to be very well functioning now, most of the interactions with smartphones and tablets happen by using the touch screen gestures. It is also important to consider that the device is hand held and in many cases the interaction happens using only one hand. This means that the functionalities should be easy enough to access with one hand only. The exception to this, at least with the younger generation users, is typing with a keyboard, that will be done by holding the device in both hands and using the thumbs to type the text.

2.2 User interface design

Designing a user interface by using methods of user experience design consists of many different areas and perspectives. The design includes considering different user groups of the system and context of use, the needs of the different user groups, interaction design, and considering different design guidelines for functionality, placement of functions in a user interface and visual design. The ISO 9241-210 standard defines the user experience itself to be *"A person's perceptions and responses that result from the use or anticipated use of a product, system or service"*. This also means that the goal of user interface design from the perspective of user experience design is at the same time create an application that meets the user's needs, is usable, and provides an enjoyable experience during the usage as all these areas affect to the whole experience.

When designing any user interface, a user experience designer usually follows human-centered design process (ISO 9241-210, 2010), or some similar process built to follow human-centered design idea. In this chapter the process of human-centered design process is explained to give more information about the process we used in during the studies we made. The human centered design related data gathering methods as well as design guidelines that are relevant to the user interface design are also presented in this chapter.

2.2.1 Human-Centered Design

When thinking the user interface design from the perspective of user experience design and usability, the human-centered design (HCD) is one of the fundamental paradigms designers will follow. Human centered design process is a framework that provides all the steps for developing solutions to human-computer interaction related systems. The official definition of the human-centered design according to ISO 9241-210:2010 is:

> *"an approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques"*

In more detail, human-centered design aims to involve the actual users and other stakeholder as a part of the design process from the very beginning of the process to make the system as suitable for the end-users as possible. This is also a way to ensure that the user experience and usability of the final product meets the needs and expectations of the end users and organizations as well as possible. Sometimes the term "user-centered design" is also used, but the term "human-centered design" is recommended because it includes all the stakeholders (UX designers, programmers, managers, marketing, customer, etc.), not just the users of the system (ISO 9241-210, 2010).

In the HCD process the users, the context of use, the requirements, end user experience and the iterative process are in the center of the thinking. A good HCD process also done with multidisciplinary team to include different perspectives and skills to the design process in addition to the users' needs and perspectives. Officially, according to the ISO 9241-210:2010, the principles of the human-centered design process are following:

1) *The design is based upon an explicit understanding of users, tasks and environments*
2) *Users are involved throughout design and development*
3) *The design is driven and refined by user-centered evaluation*
4) *The process is iterative*
5) *The design addresses the whole user experience*
6) *The design team includes multidisciplinary skills and perspectives*

The process is fairly simple and the goal is to repeat the process information gathering and testing process by utilizing the gathered information to provide design solutions and then evaluating each design step with real users. If the design is not satisfactory, new iteration of the design is made, and if the design meets the requirements, the user interface is ready. The process can be also divided into four main activities called *1) Understand the specify the context of the use, 2) Specify the user and organizational requirements, 3) Produce design solutions, and 4) Evaluate designs with users against requirements* (ISO 9241-210, 2010). The process is also presented in the figure 1. In the picture there is also a beginning part to the process called *"Identify need for human-centered design"* and the end called *"System satisfies specified user and organizational requirements"* (ISO 9241-210, 2010). Sometimes in the beginning of the process we may be in the situation where is no previous experience about using HCD process, and in that case, we should identify the need and design the process first. The whole process ends when the users' and organizational requirements are satisfied.

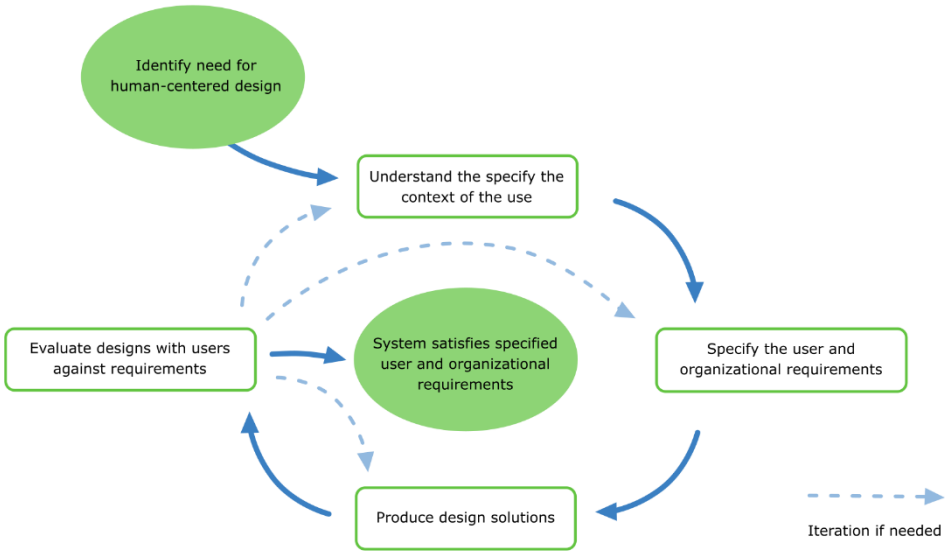


Figure 1. *Human-Centered Design Process*

Following the human-centered design process has many benefits. For the user's perspective, among other things HCD improves usability, users make less errors during usage and it is faster to learn use new systems (Norman, 2005). The improvements in these areas are usually also beneficial for the companies developing products. For example, good usability aims to improve effectiveness, efficiency and satisfaction (ISO 9241-11, 2017) of the system for specified users performing specified tasks. If a system, product or service is designed for specific users doing specified tasks, it is also more likely that there is no need to make so many expensive corrections to the design afterwards and the users will be happier and spread the word about the good product which can also mean more income for the company.

There are also other similar processes used in user experience design work, e.g. Lean UX, Service design and Contextual Design. Also, some companies have developed their own human centered processes where they use methods or models they have developed for themselves to support their company culture. In the end, all of the processes have the same kind of ideology and they aim for the same goal as human-centered design. All the different processes also utilize interviews, observations and iterative design methods as a part of the processes but they also include different tools and emphasize importance of elements of design differently. For example, Lean UX aims for the fast development and delivery via minimal viable product ideology and highlight the importance of agile teamwork (Interaction Design Foundation, 2017). Where the human-centered design seems to mainly offer a process to follow, the Contextual design on the other hand provides a designer a large set of tools to gather, analyze and present user data as well as ways to drive data based ideation, design solutions and iterate the designs with customers (Holtzblatt, 2015). There are also other similar processes but all have the same basic idea of design driving from knowing the context and knowing the users.

During whole project and all the studies, we did during the Liikuttavat työtavat project, we strived to follow the principles of human-centered design. Our project started with a study of possible users' needs and ideas, both of our prototypes were built based on the users' comments, and the changes in the concept and design were based on the users' comment gathered in evaluation sessions. Overall the goal was to make the experience of the walking meeting and the usage of the walking meeting app prototype the best possible. The project and the studies are presented in more detail in a later chapter of this work.

2.2.2 Data gathering methods

To get to know the context and user, there are some basic tools a designer can utilize to collect information. The most common ones in the beginning of the process when collecting information about context and the users, are qualitative methods like *observation* and *interviews*, or even *focus groups*. When iterating the product and collecting data about the usability and experiences, the same methods can be also used. In addition, if the designer cannot be present when the system is used, for example during long pilot studies, *diaries* and *surveys* can also be used to collect data during independent usage of the system.

As the human-centered design process is mainly based on the data that is gathered from the users, and in many cases qualitative methods are the most effective methods to use for data gathering. As quantitative methods, such as surveys, questionnaires, automated data gathering, may seem to offer an access to a large number of users, the qualitative methods, like observations and interviews, provide deeper and more personal information even if the number of participants is also usually lower. On the other hand, the quantitative methods usually are good in the later part of process when iterating the design solutions, for making market research or for data analytics. (Cooper, 2014) As quantitative methods can answer to questions "how often?" or "how long?", the qualitative methods can answer to question "why?" (Lazar et al., 2017). The question why is one of the most important question people in the field of human-computer interaction (HCI) and user experience design will ask. The following methods will help designers to find answers to this question.

Careful preparation is a key of using any of the data gathering methods. Before jumping to using the data gathering methods there are some steps that are important to go through before running any interviews or tests. First it is vital to *set your goals*. When you have defined what do you want to learn, it is also easier to decide how you will run your study and choose which data gathering methods you need to use to get the right information. Another important step is to *identify your participants*. When you know your goal, you can also define who are the people that belong to your target group and can give you the information that will answer your questions. You may also have to think about how to choose the participants so that the data your get is not one-sided. You should also how you *build a confidential relationship with your participants*. Usually giving a participant a consent form to sign will help you with this, and it is also important to remember that there are many cases when it is required that you have consent forms so that you can use the data you have gathered. Finally, it is always a good idea to practice having a *pilot study* before you

conduct the real study. That way you can make sure the plan you have made provides you the information you need, and at the same time you can spot probable problems and make changes to your plan if needed. It is also important to list what equipment and materials you need to run the study sessions. (Rogers et al., 2013)

There are several different methods that can be used for gathering data from the user. In this chapter I will go through in more detail the methods we used to gather data during our studies. These methods are interviews, focus groups, observation, diaries, and questionnaires.

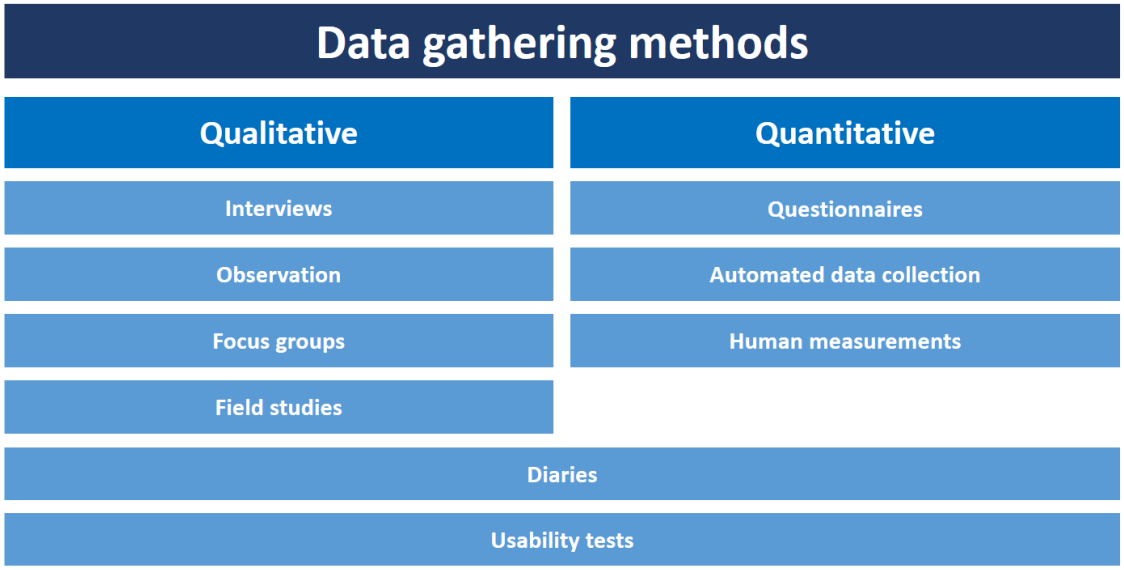


Figure 2. *Human-centered data gathering methods*

Interviews are individual face to face meetings with the people who belong to the specified group of people who will use or could be using the designed system in the future. The interviews provide information about the practices, concerns, needs, preferences and attitudes of the people in your target group and the the questions can be open or closed. The interviews can be conducted on their own, but they are also a strong tool to combine with other methods, like usability studies and surveys. The interviews can also be used as any phase of the project, and the biggest strength of the interviews is that they provide deep knowledge about the users and their thoughts. Interviews are also flexible in a way that surveys are not. Interviews can be structured semi-structured or unstructured. Even if the interview always has a pre-defined set of questions, it is possible to ask additional questions or change the order of the questions if needed. This also means that interviews can be also challenging work and they consume a lot of time. Also analyzing the collected data can be challenging as you may have to transcribe the answers to the physical notes, and decide what is important and what is not. To build a comprehensive picture of the situation, it can be beneficial also to combine interview results with observation notes. (Lazar et al., 2017) It is also important to remember to include both current users and potential users to the interviews even if you would be redesigning an exciting product (Cooper, 2014).

Focus groups are also interviews, but there are multiple participants present at the same time. As interviews can take too much time, sometimes it can also be a good idea to interview multiple participants at once. This can save time and increase the number of participants you are able to include in the study. Having several participants in the interview at the same time also provides a possibility to get a wide range of viewpoints and thoughts about the topics in hand. Conversation in a focus group also sets its own challenges to the interviewee. The discussion may drift to a conflict or participants may not want to talk about sensitive topics freely in a group. There is also a chance that very talkative participants can dominate the conversation. That also means that the interviewee must be a skillful facilitator who can manage conflicts and encourage all the participants to speak. When focus group conversation is successful, it provides versatile insight about different users and may even open totally new perspectives to consider. (Lazar et al., 2017) Running a focus group session can also help you to reveal conflicts in terminology or expectations inside an organization or group of people. It also especially important to emphasize that different opinions are valued and the group does not need to agree about all the things. (Rogers et al., 2011)

Observation is a method that is often used together with interviews to gather deeper knowledge about the users' activities and operation during some tasks or interaction with the system. People are usually not able to describe their behavior and action in detail with words in interviews, so in many cases it is also very beneficial to see how people behave and perform certain tasks in real life setting. People may also be embarrassed to tell about the problematic situations that they have faced with technology. It is usually a good idea to take photos and notes about the observations. When taking photos, it is important that you have established a good rapport with the participant and they don't feel uncomfortable about the observation. (Lazar et al., 2017) The observations can be used in any stage of the product development they organized in different ways depending of the current goals of the study. The observations can be conducted in the field or in the laboratory setting, and the observation can be direct or indirect. The observer can also be passive and not taking part in activities, or the observer can take a participatory role in the and take actively part in the activities. Regardless how the observations are done, the aim of them is to provide information about the context, tasks and goals of the users as well as how the users behave and act in certain situations. (Rogers et al., 2011)

Questionnaires are a tool used for collecting demographic data and users' opinions. In the same way as in the interviews, the questions can be closed or open questions and the questions should be worded carefully so that they are easy to understand and that the data can be easily analyzed. Questionnaires a good tool for gathering data from a large group of people of from a group of people who are geographically spread in a wide area. Questionnaires can be used individually or together with other methods to deepen the knowledge and understanding. When designing the questions, it is also important to consider the length and the order of the questions in the questionnaire. Many questionnaires start by asking demographic information and then details about the actual topic. When using closed questions in most cases it is best to offer a range of answers and an option that states "none of these". The demo-

graphic information gives the questionnaire answers a context, but it is also important to acknowledge that it is important to only ask for information that is relevant to the study. Questionnaires can be done both on paper or as online surveys, but it is important to choose the method that will help you to reach your target group. (Rogers et al., 2011)

2.2.3 Design principles and guidelines

Currently there already are some well-known design guidelines and principles for user interface design. Some of the guidelines are more general and can be applied to any kind of user interface design starting from physical interfaces to virtual ones. There are also guidelines that are specifically directed for example for web user interface design or mobile user interface design purposes. These kinds of guidelines are in most cases based on scientific research and give a good general idea what kind of things should be considered when designing a user interface. They are a in many ways checking lists you can use to go through your design and see that the most basic things of design are covered.

One of the most known set of guidelines is Shneiderman's "Eight Golden Rules of Interface Design" (Shneiderman, 2010.). These guidelines guide the design in very general level that is easy to apply both physical and digital user interfaces and interaction design overall. Other similar more general level guidelines are Norman's Design Principles (Norman, 2013) and Nielsen's 10 Usability Heuristics for User Interface Design (Nielsen, 1995). These guidelines guide designers to pay attention for example to things like error prevention, consistency in design and interaction, feedback and recognition what you can do with the user interface and what is the status of the system. Overall, they are quite close to each other providing 7-10 guidelines each.

As these guidelines are quite general, it is can be a good idea to get t know some other more specific guidelines too. For mobile platform there is variation of Eight golden rules to the mobile design by Gong and Tarasewich called "Guidelines for handheld mobile device interface design". They explain that as the original eight rules were found before the current type of mobile phones existed, some of the rules don't apply the best possible way to this platform, and that is also why they have provided improved guidelines for mobile based on original guidelines (Gong, 2004). Some other more detail mobile and interruptions related principles are Oulasvirta's studies about how people interact with mobile phones. One good example of his studies is the one where interaction while doing other tasks in the city was studied (Oulasvirta, 2005).

Another kind of set of guidelines that user interface designer should know and consider in their design are platform and operating system related user interface design guidelines provided by the companies developing these platforms or systems. Good examples from the mobile environment are Google Material design guidelines and Apple's iOS Human Interface guidelines. These guidelines provide information about the topics where some certain common buttons should be located and how they should look as well as give ideas how interaction with specific user interface elements

should act when user interacts with them. These guidelines are provided to the designer to keep the user experience on one platform as consistent as possible as well as providing some examples how present the same information in multiple ways without breaking the experience. Following these guidelines ensure that your design will better meet the user's mental model of the interaction with the application. Also, when knowing these guidelines help you understand what rules you should always follow and what guidelines can be altered depending on the topic on of your application.

Overall design guidelines will help you to check that your design follows the most well-known and appropriate ways of design. By using the guidelines as the support of the design work, you are able to check the areas where it is fairly easy to do the mistakes. Even if the guidelines are very handy, it is also good to remember that the guidelines do not replace real life user tests but for example when doing the initial designs or moving on from wire frame towards final user interface picture, the guidelines will help you to remember the most essential things.

2.3 Summary

Designing an application and user interface for mobile, or any platform at all, requires considering many different aspects from user experience all the way to the actual user interface design. Designing an efficient and enjoyable user interface will require studying your main user groups and the context of use and defining the most important tasks of the users and considering what is the problem your application is going to solve. Knowing your users and the context of use is the key for performing the human centered design process.

To get to know your users and the context of use, you can use multiple different ways to collect the information from interviews and observations to questionnaires and diaries. When starting the design process, it is important to think about what are the right information gathering methods and tools for the project in hand. Usually in the beginning of the project it is more important to gather qualitative data with interviews and observations and towards the end of the development it may be important to measure for example efficiency or satisfaction on qualitative level with usability tests or questionnaires.

When moving toward the actual user interface design it is important to try and fail fast rather than try to build a perfect and complete design at once. For this you can use different prototyping tools from paper prototypes to different computer programs that allow you to make low-fidelity prototypes that simulate interaction without any actual coding. At this phase it is also a good idea to include some design guidelines into the design process in the addition to the user study results. In some cases, it also may make sense only to test some certain technological solution with very little user interface implementation to gather ideas of the feasibility of the actual technological solutions. Considering the schedule and the budget of the project it is also important to think what are the right development methods for the current project.

When the first initial design has been implemented, it is time to also run some user tests. Usually it is a good idea to run the tests as soon as there is any kind of first design or implementation that can be showed to the users. Any kind of feedback is usually better than nothing and it is important to validate your design solutions to make sure that the design is going to the right direction.

Overall the ideal human centered design process provides deep knowledge about the needs and expectations of the users and it is very suitable method also for mobile application design. As the demand is to usually build an application fast, knowing your users and the context of use ensure that the design and the development are solving the right problems from the beginning on the process. As the process is also iterative, the design can be done efficiently and divide the design process into appropriate phases to speed up the process.

3. MOTIVATION AND PERSUASIVE DESIGN

In this work the goal of the mobile application concept is to find a way to support and inspire people to alter their way of working from mostly sitting to some walking and less sitting. Changing our habits though requires making a conscious decision and having right amount and right kind of motivation. The best kind of motivation for habit change is internal motivation. But if the motivation level is not optimal for the habit change, it is also possible to guide motivation with right kind of external cues towards the more internal motivation.

On the other hand, persuasive design offers us tools to understand the different factors that need to present when starting a habit changes and help us create right kind of conditions for the habit change by using technology together with right kind of conditions. Even if the motivation gives us the spark to take actions, there are also other important things that should be considered in design when trying to change one's behavior.

3.1 Motivation

In a broad sense motivation is the force that moves us and make us do things or as Ryan and Deci put it "To be motivated means to be moved to do something". (Ryan et al, 2000a) All humans are in their profound nature curious and playful and ready to explore new things - but as we grow up we also develop some personal preferences what motivates us and what not. Some things give us more enjoyment or satisfaction and other things we do because we feel we must do them. Some things may even be completely uninteresting to us and we avoid them.

When considering all the things you can, should or don't want to do, we soon ask why we feel motivated about some things and some other force us do and some we would rather skip. To explain these feelings, we need to understand the terms intrinsic and extrinsic motivation. Intrinsic motivation means that a behavior is driven by internal powers for fun or challenge whereas extrinsic motivation means that some action is taken for some instrumental value, for example for reward or making parents happy. (Ryan et al, 2000a)

In general, if person decides for example learn a new language, the reasons for the action may vastly vary from individual to individual. Taking the course may be mandatory the reason may be that that the individual is has an internal interest and spark to learn the language. It has been studied that in the first case where the motivation for learning the language is extrinsic, the learning outcome may be poor and shallow. The same study also reveals that, like in the second case, when the motivation is intrinsic, the learning outcomes are usually much better. (Baard et al, 2004) The same way changing a habit is usually much easier when you feel intrinsic motivation instead of extrinsic motivation.

The idea of the intrinsic and extrinsic motivation is widely accepted as basic motivators but different theories have their own view and explanations to the causes of the different types of motivation. Many of the current theories are developed based on the existence of these two types of motivation, but each one of them have some different view and perspective how they approach the explanation these two types of motivation. One of the most known motivation theories is the Self-Determination Theory, and this is the theory that seems to also be the most relevant theory to this work.

3.2 Self-Determination Theory

Self-Determination Theory (SDT) is one of the most known and widely studied motivation theories. The theory has branches among the other things in the fields of education, organizations, health and medicine, parenting, virtual environments, and sports and physical activity. SDT includes six mini-theories that are Cognitive Evaluation Theory, Organismic Integration Theory, Causality Orientation Theory, Basic Psychological Needs Theory, Goal Contents Theory, and Relationships Theory. (self-determinationtheory.org, 2018)

3.2.1 Intrinsic and extrinsic motivation

Self-Determination Theory is based overall on the idea of intrinsic and extrinsic motivation but they also state that there are not only different levels of motivation but also varying orientations of motivation. Where the level of motivation tells us how motivated one is to do something, the orientation of the motivation shows why some action is taken revealing the attitudes and goals that makes us take the action. We also have psychological needs that need to be fulfilled to achieve the most high-quality levels and orientation of motivation. (Ryan et al, 2000a) The basic idea of the STD is to support out intrinsic tendencies to act in effective and healthy ways and try to move the extrinsic motivation towards the more beneficial levels of behaving. The set of six mini-theories Cognitive Evaluation Theory, Organismic Integration Theory and Goal Contents Theory explain the intrinsic and extrinsic motivation more deeply.

Figure 3 shows how the different stages of motivation are formed and when the motivation starts to. Where the original theory of intrinsic and extrinsic motivation only presented two possible stages of motivation, SDT presents more variety and varying motivational levels within these two categories. On the general level the stages of motivation progress from Nonself-Determined towards Self-Determined motivation. Within this range people's motivation can vary from amotivation, to passive compliance, to active self-driven commitment. Starting from the left side, amotivation is the stage where someone has no will or intention to act. Amotivation can be caused be the feeling of not giving value to the activity, not feeling the competence, feeling not competent, or expectation of not getting the valued outcome. (Ryan et al, 2000b)

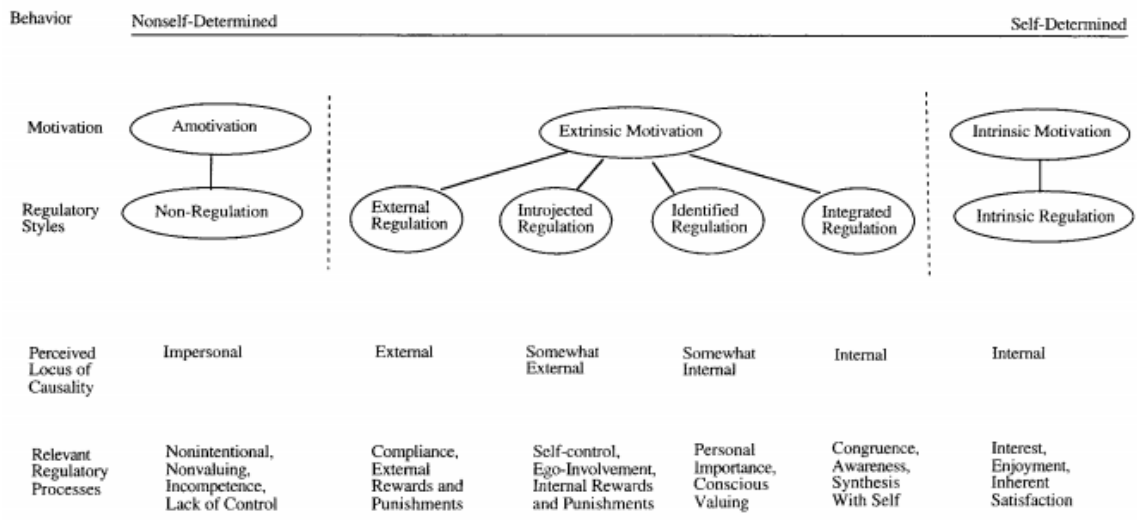


Figure 3. *Different levels of motivation and the orientation of motivation, (Ryan et al, 2000b).*

When proceeding to the right in the picture, there is an area of extrinsic motivation. This area has four stages where the perceived locus of causality shifts from external toward internal step by step. On External Regulation and Introjected Regulation stages individuals perform actions for external or somewhat external reason. The reasons can be for example compliance, rewards, punishments, self-control, or ego-involvement but none of these reasons are for internal reasons and the action is not seen as part of their selves. (Ryan et al, 2000b) On this two stages people usually get things done but they don't necessary see or feel that the things they do has a meaning for themselves.

Progressing closer to the intrinsic motivation the next two stages are Identified Regulation and Integrated Regulation. These two level have somewhat internal or internal locus of causality and individual performing actions in these stages do things for example based on feeling that the activity is important, personal, valued, or if the activity has been assimilated with self. Especially Integrated Regulation is very close to the Intrinsic motivation, but still the actions are taken more for external outcome instead of actual enjoyment or interest. (Ryan et al, 2000b) When thinking about learning a new habit or changing one, this level of motivation is already very beneficial and helps with performing and maintaining the activity.

The final stage of motivation is pure intrinsic motivation where action is done for internal interest, enjoyment and satisfaction. Taking actions from the intrinsic reasons is highly autonomous and self-determined. (Ryan et al, 2000b) Even if the intrinsic motivation level is seen as the most efficient and beneficial stage of motivation, it does not mean that we can always reach that level in everything we do. Realistically there are always things we have to do also for external reasons and not only for joy, and that also makes understanding and carefully considering the different levels of external motivation very important.

The studies in the area of SDT have also shown that it is possible to change the level and orientation of the motivation towards more intrinsic or more extrinsic motivation

when person if affected by certain types of external feedback or behavior. It is also shown that the motivation does not have to follow certain steps (see Figure 3) and it skip steps and change the orientation freely depending the extrinsic forces and feedback and how they make us feel. (Ryan et al, 2000a) For example according to the studies, the intrinsic motivation can be facilitated by optimal challenge, effectance-promoting feedback, and freedom from demeaning evaluations (Ryan et al, 2000b). These notions also make SDT an important part of designing a motivational application, or any application at all. When doing the design, it is important to acknowledge that it is not only possible to affect the user's motivation but also it can change from worse to better or vice versa, depending how successful the used motivation method is in the context.

3.2.2 Autonomy, competence and relatedness

SDT also presents three factors that are related to the high levels of motivation. In short, the conditions that support an individual's experience of autonomy, competence and relatedness seem to shift the motivation towards the most willing and high-quality levels of motivation. And as reaching the highest quality levels of motivations boost our performance, persistence and creativity and help us feel engagement for activities we are performing, it is worth to aim to provide these conditions for individuals to boost their motivation. (selfdeterminationtheory.org, 2018)

The mini-theory called Basic Psychological Needs Theory covers the concept of autonomy, competence and relatedness and the environmental factors that can support or hinder the fulfillment of these needs. The SDT itself does not tell us what causes intrinsic motivation but reveal conditions in which intrinsic motivation is sustained and nourished or diminished. All children are born to be naturally curious, exploring, and spontaneous in order to master and assimilate new cognitive and social skills, and they don't need any rewards to encounter the actions to learn and grow. (Ryan et al, 2000b) But as we get older we start to sense our environment differently and we begin to interpret external pressure, support, or other feedback that can help or discourage us to maintain the motivation.

SDT states that autonomy, competence and relatedness are the three factors that we all need on psychological level to enhance or maintain the motivation. For example, the Cognitive evaluation theory has shown that when facing optimal challenges combined with effectance-promoting feedback with no mortifying evaluations will facilitate intrinsic motivation by creating the feeling of competence. The same study also shows that individuals must have the feeling of competence and sense of autonomy at the same time so that the intrinsic motivation will actually be enhanced. (Ryan et al, 2000b) This means that when facilitating intrinsic motivation, we have to try to create environment where people feel that they are able to take and action as well as the activity is voluntary and not forced. The things that on the other hand can hinder the intrinsic motivation are tangible rewards and threats, deadlines, directives and other external forces (Ryan et al, 2000b). When designing a motivational technology, the free will and feel of competence are two important factors.

The third psychological need related to intrinsic motivation is the sense of relatedness. Even if the competence and autonomy have in many cases seen as the most effective feelings, the relatedness is an important matter when considering our environment. For example, children seem to perform tasks better when they act in the closeness of a familiar adult who pays attention to them. (Ryan et al, 2000b) On the greater view, people overall and everywhere seems to try to find other people around them who think and feel the same way as they do and like similar things. Having the supportive group of people who don't judge us will also help us to facilitate the things we are intrinsically interested about.

Overall, even if all these three psychological needs are important and all people are driven to reach these feelings, we also have to remember, according to Ryan et al., that to feel intrinsic motivation we also have to hold true internal interest and see the novelty, challenge or aesthetic value in the activity we are about to do (Ryan et al, 2000b). That means that we have to recognize the type and level of motivation to support the motivational activity in best way possible, whether the motivation is intrinsic or extrinsic.

3.3 Persuasive design

Persuasive design is part of the field of captology that is an area of human-computer interaction research that studies interactive computing products that are created for the purpose of changing people's attitudes and behaviors. (Fogg, 2002) The word persuasion itself, as B.J. Fogg defines it, is an attempt to change attitudes or behavior or both. In more detail persuasion implies a voluntary change and it is not the same thing as coercion or deception that are easily mixed with the word persuasion. (Fogg, 2002) The aim of persuasion and persuasive design is to gently guide users towards better habits or behavior.

According to Fogg, there are many examples of persuasive design around us and there are multiple technologies that try to change our behavior in some way or affect us. The examples can be found on the web, in video games, in mobile apps and on television. There are also specific devices that are designed for persuasion such as pedometers or scales that send our measurements to the web service to track them. (Fogg, 2009b) Some of these services and technologies try to help us to live a better life. For example, physical activity trackers or meal and calorie counters aim to help us and not trick us to do things. On the other hand, there are also more controversial examples of persuasion, such as trying to make us buy things or make us watch just one more episode of our favorite Netflix series. It is also easier to watch one more episode of TV series than to learn take a 30 minute walk every day. Fogg Behavior Model explains why some behaviors are easier to achieve than others and on more concrete level Fogg's eight-step design process gives advice how to design persuasive technologies.

3.3.1 Fogg Behavior Model

The persuasive design is based on the Fogg Behavior Model (FBM) that gives the basis of all the persuasive design ideas and guidelines. Fogg Behavior Model consist of three factors that are motivation, ability and triggers. The model combines three factors together and addresses that a person must be sufficiently motivated, have an ability to perform the behavior and be triggered to perform the behavior for the target behavior to happen. Also, the three factors must take place at the same moment or the target behavior will not happen. When designing or analyzing a persuasive technology, this model can be utilized for better results and it can also make team work easier when everyone is looking behavior change through the same lenses. (Fogg, 2009a)

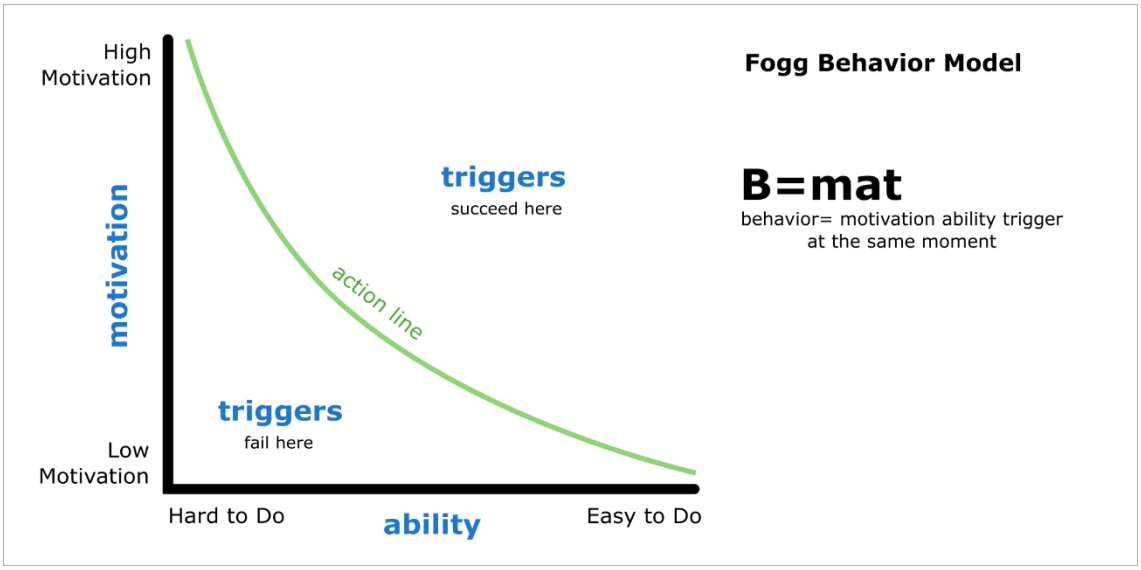


Figure 4. *Fogg Behavior Model, (Fogg, 2018)*

In the figure 4 you can see Fogg Behavior Model visualized. The idea of the overall model is that if some task, for example a new habit, is hard to do and you don't ability to do it, you also need a high motivation level in order to trigger for the action to work. On the opposite case, if some action is easy to take, you will need only low level of motivation in order to trigger the action. On the other hand the behavior happens only if a person has the ability to take the action, the motivation is high enough in comparison to the degree of difficulty of taking the action, and the trigger happens at the moment when both ability and motivation are on the sufficient level. Overall, according to Fogg it is usually easier to get results by making the behavior simpler (to increase ability) than trying to raise motivation because people usually resist attempts at motivation but we love simplicity (B.J. Fogg, 2009a). When designing any persuasive application that is an important note to remember.

This model is closely related to the motivational factors and Self-Determination Theory presented earlier in this chapter. When thinking about the different levels of motivation from amotivation to intrinsic motivation, it is easy to see based on the figure 4 that if some things are easy to do, it also requires a lower motivation level to trigger the action. With high motivation level, it is on the other hand easier to take actions

that are harder to do. From the other perspective this also means that if a user gets a trigger on the moment that there is no motivation or no ability to take the action, the trigger and taking the action will fail. In order to design a successful persuasive technological solution, it is important to try to make the tasks easier, try to motivate users and recognize the moments when user has ability to take the action, and give the trigger only when the ability and motivation are high enough so that the action can happen.

Overall Fogg Behavior Model gives more practical view to the facts how motivation affects to the people actions and how the technology can be designed so that it helps people to overcome the difficulties on behavioral level. The model shows that it is not only the motivation that is important but there are also other factors that has to be considered. To get more detailed view into the steps that are needed in the design, we have to take a look at the Fogg's eight step design process for persuasive technology.

3.3.2 Fogg's eight-step design process

Fogg's eight-step design process is aimed for helping the process of designing persuasive technology. The steps are designed to take a place in sequence at the same time considering the circumstances of the process. As designing persuasive technology or solutions is not easy and the failure rate is high, the eight-step process is aimed to raise the success rate of these kind of services. The idea of the process is to first think carefully what is a small enough target behavior and then achieve the goal of development in small steps by measuring the design on the way. (Fogg, 2009b)

The steps of the process are following:

Fogg's eight-step design process

Step 1: Choose a simple behavior to target
Step 2: Choose a receptive audience
Step 3: Find what prevents the target behavior
Step 4: Choose a familiar technology channel
Step 5: Find relevant examples of persuasive technology
Step 6: Imitate successful examples
Step 7: Test and iterate quickly
Step 8: Expand on success

The process starts with the first four steps, and the first step of the process, according to Fogg, is the most important one. Choosing a simple behavior for the target of is in many cases the thing that will make the persuasive technology successful. Also, when people achieve a small goal it may have bigger impact than expected. (Fogg, 2009b) For example, in the case of walking meeting, the big goal could be that people are having more active working lives every day. The smaller goal in this scale is to motivate users to use walking meeting once a week and help them reflect the benefits. Achieving small goals is overall easier and in that level the idea also makes very much sense.

The steps 2-4 are about finding your target audience who have right kind of attitude towards the behavior change, defining what factors are preventing the target behavior and choosing the right technology platform for your design (Fogg, 2009b). These all steps are about learning about your target users and finding out what they expect and need and what is their situation and habits at the moment. according to Fogg, during the step four, it is also required to look the technology not only from the perspective of your target users but also from the perspective of the target behavior and what is preventing them from adopting the behavior.

The steps 5-8 are more about development where the first four where about defining your idea, target group and the problem to solve. The idea of these steps is to get to know other successful persuasive designs and learn from them before designing your own solution, and also start with small steps and build the technology step by step. Overall the first 7 steps are meant for design team to use during the design process and doing the pilot and the step 8 is taken when proceeding to launch the first product. (Fogg, 2009b)

In many ways this process is quite similar in comparison to the Human-centered design process presented in the previous chapter but it also gives more detailed advice how to proceed in the process when aiming to design a persuasive technological solution. At least the first four steps of the process guide designers to acknowledge certain views and matters when collecting data during the user studies and from context of use. Combining these process with HCD process will help to gather right kind of answers from the users and also keep in mind the motivational factors during the user studies and design. Overall the persuasive design is an important factor when designing a motivational and behavior changing technology or application.

3.4 Summary

All in all, there are many different theories about motivation that all are based on the idea of intrinsic and extrinsic motivation. Self-Determination Theory was selected for this work because it seemed to be one of the most known theories of motivation and it also had been studied from many different perspectives and in many different application areas. The SDT also gives a holistic view in the motivation in different levels and it explains how motivation works as well as how the motivation levels change from time to time. Understanding the motivation in detailed level will help us help us understand our target users and their goals and needs better. By thinking about the three psychological needs linked to the intrinsic motivation we are also able to understand more deeply how our environment affects the motivation.

As the motivation itself is not enough to help us form a new habit and other factors are also needed, the persuasive design offers concrete ideas how to facilitate motivation through technology. By selecting right kind of and small enough behavior for the target of change, it is possible for example support the feeling of competence and autonomy when the new habit is successful and it has happened by rules that users set themselves. Where SDT gives us knowledge to understand motivation, the persuasive design helps us to apply the right kind of tools via technology to support the habit change.

4. STUDIES OF USER EXPECTATIONS AND EXPERIENCES

The concept that is presented in this thesis is based on not only the existing theories and guidelines covered earlier in the thesis but also on the two studies and a pilot (Figure 5) we conducted during the POP UP project. The user studies were done during the autumn 2015 and spring 2016 in the Tampere University of Technology. I was the part of the project as a research assistant and my tasks in the project included taking part in all parts of the research including user studies, handling the results and analysis, designing and implementing the prototypes as well as recruiting the participants to our studies. Some of the tasks were more independent, such as implementing the prototypes for the studies, but most of the tasks were done together with the researcher responsible of the study.

All the three studies presented in the Figure 5 were user studies that tested our idea of walking meeting application in different development stages during the project. The first user study was about learning about user's needs and expectations about walking meeting application and it built the base to the first prototype version. The second study was about testing the first walking meeting prototype with the users and learning further how to iterate and improve the prototype before the pilot. The third study was about collecting walking meeting application experiences during a four weeks pilot when users utilized the iterated application as a part of their daily work as they would actually use the app if it was published.

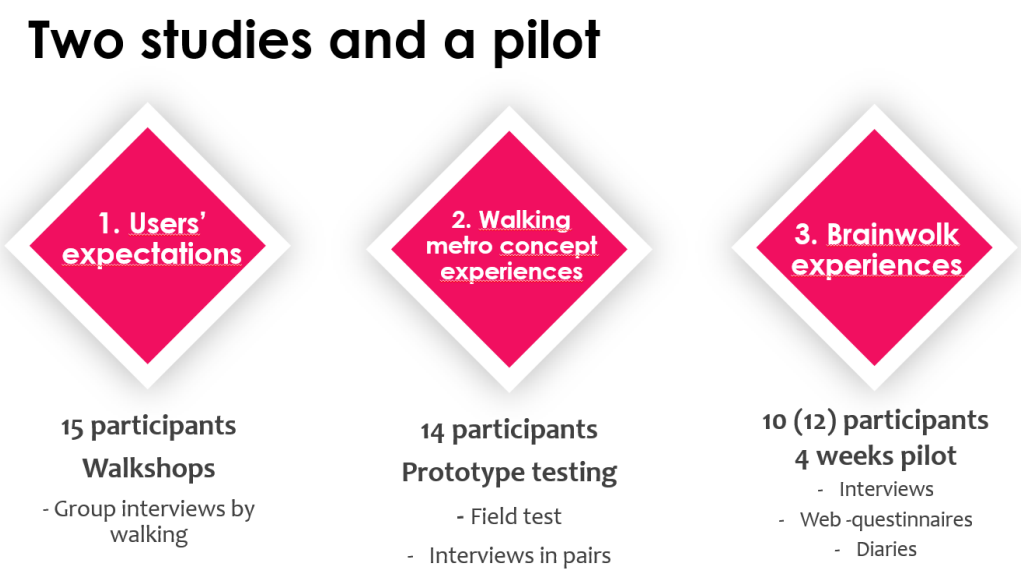


Figure 5. *The walking meeting user studies done during the project*

In the studies the goal was to find out what motivates people to use walking meetings as a working method, what kind of role a walking meeting application can take during the walk and what kind of features and functionalities a walking meeting application should and should not include. Along the way we uncovered other aspects of the walking meeting, e.g. how a walking meeting makes us feel, what kind of meetings a walking meeting is suitable and how a walking meeting affects us etc. In this chapter I will give an overview of the three studies we made, how they were conducted and what kind of results we got. In the all the studies our target user was the knowledge worker who sits most of the day in front of a computer. The study process was iterative and we utilized the Human-Centered Design Process presented in the earlier chapter as our way of doing the studies.

We started the project by collecting ideas and expectation about walking meetings and walking meeting application involving the possible real users. Then we designed our first prototype based on these ideas and expectations, but we also included a few features that were our own idea to see how they would work in as a part of the application. We tested the prototype in a field study where users utilized the walking meeting app independently by taking a single walking meeting outdoors while talking about work related topics. The results of the study were analysed and a second iterated prototype of the application was created. This prototype was used by participants for four weeks also independently as a part of their normal working days. The results were analysed and as continuum of the project, this thesis is the one of the final iteration steps on the way towards a user friendly and useful walking meeting application.

Both previous prototypes called "Walking metro" and "Brainwolk" had a slightly different approach to the guidance of users, routes and content that was show for the users during the walk. They gave us some important results how to design a motivating mobile application for walking meeting purposes in the work environment. As the final study still left us room to improve the application this thesis was started to create final example how a standalone walking meeting application would work.

4.1 Background for walking meeting application

We wanted to design a walking meeting application for knowledge workers because our current way of working and the facts how the current working conditions are affecting us. Our lives have become more and more sedentary over the last century after characteristics of both our work and free time has changed from physical to more and more inactive. According some studies we may sit half of our work day (Jans et al., 2007) or even more, and that is very much the reality at least for knowledge workers. Technology has made many things easier for us – we can drive or take a bus to work, many of do knowledge work sitting in front of a computer and after arriving home we have Netflix and Youtube to serve us an endless stream of entertainment. As much as we may enjoy the sedentary life, we cannot deny our decreasing physical fitness also affect to our physical health. For example, indications of relations between sedentary lifestyle and type 2 diabetes have been found in two studies (Hu FB et al. 2001 & 2003) and mortality from cardio vascular disease and all causes in one study (Katzmarzyk, P. et al, 2009) in recent years.

On the other hand, the knowledge work requires some type of creativity regardless of the job description. Instead of using our body, we use our brains but the physical inactivity also affects how our brain work. Staring a computer screen whole day may give an impression of the efficient worker but we all know that is not the reality all the time. Taking a walk can also help to give our brain the boost we need when we are stuck with thoughts. For example, the study of Oppezzo M. et al. (2014) reveals that walking can give boost to ideation and cognitive capabilities both real time and shortly after the walk, and our own studies showed that walks can open new paths to thoughts. Physical activity at work can also affect to happiness in long term (Wang, F. et al., 2012) and sociability (Wickson, F., 2015) at work.

Figure 6. *Ordinary knowledge work setup vs. adjustable table setup vs. walking meeting*

There are also other solutions created and researched to solve the problem of physical inactivity at work. Some examples are of these solutions treadmill desks that allow us to walk at our working station while we work (Koepp et al., 2013), cycling stations (MacEven et al., 2015) and stepping/balance devices, such as Gymba board, that allow you to move other ways while we are working at the computer. There are also less activity boosting solutions height-adjustable workstations that allow us stand instead of sitting, and also some furniture that recognize our pose and activity levels (Braun et al., 2015). Even if these solutions allow us to move while we use the computer, none of the solutions really consider the fact that the time we use in front of the computer is not always 100% productive, even if it can seem so. We can find ourselves slacking or just feeling that our brain isn't productive anymore or we are losing the big picture of what we are working on. And that's where a walking meeting comes into the picture. As described before, leaving our computer and desk behind and taking even a small walk can help our brains and body to wake up. That is also why we wanted to offer a tool that provides us the means and permission to step away from the computer and do some productive work outside our normal working environment.

As our working environments are changing to support different modes and ways of work, and we start to realize that different types of tasks require different kind of

ways and methods to work, the walking meeting culture is more easily adaptable to our working life. As most people have not tried a walking meetings in practice, the walking meeting application is a good and easily adaptable way to make walking more acceptable and known working method. The following studies were also conducted to reveal what would be the best way to build a walking meeting application – what are the most important functionalities, how the application should support in introduce the walking meetings and what would motivate the users to keep doing the walks. The goal of the application is to help working people realize how even a short physical activity can improve their work days and what kind of tasks a walking meeting can be used for.

4.1.1 Study 1: Users' expectations

The first walking meeting study focused on exploring users' expectations, motivations and needs towards walking meetings and walking meeting application. We had 15 university employees (F=11, M=4) taking part in the study and all the participants were knowledge workers. Participants were working for example as researchers, teachers, coordinators and secretaries and their age range of participants was 25-65 (mean = 41). Their work was overall sedentary and they estimated that on average they sit 70% of their workday. Most had some physical exercise after working hours for 3-5 hours/week and 10 of the participants had been using some kind of physical activity tracking app or device (e.g. Sports Tracker, Withings, Endomondo).

Figure 7. *Paper maps that were used in the first study to guide participants*

In this study we used Walkshop (F. Wickson, 2014) as our research method in groups of 3-5 people. The group session started with a discussion the meeting room and after that participants took a walking route around the campus area both indoors and

outdoors with four predefined meeting points. Participants got 2-3 questions to discuss in pairs between the points and on each point pairs shared their thoughts and ideas they had discussed during the walk and some additional questions were asked to define their thoughts. The discussion topics included questions about following topics:

- Had participants tried or been using walking meetings before?
- What kind of tasks they thought would be suitable for walking meetings?
- What would be a motivation to go for a walking meeting?
- What kind of routes they would take?
- How to promote walking meetings in campus?

The discussions were audio recorded, transcribed and analyzed, and the results were used for building the first walking meeting app prototype called Walking Metro. Later, the data was also used for the formation of ten design implications in comparison and together with the 2nd study results (Ahtinen et al, 2016).

4.1.2 Study 2: Walking metro concept

The Walking metro concept was designed based on the users' expectation results from the first study. Walking metro was also the first functional prototype of the mobile walking meeting application idea. The prototype was built using ActionTrack platform that is a tool that can be used to create location based experiences for smart phones, and it consists of a web-editor that is used for creating the templates and of a mobile application that the experiences are accessed by the end users.

Figure 8. *The overview of the walking metro concept indoor and outdoor lines*

The Walking metro itself consisted of an indoors and an outdoors walking metro route (see Figure 8) and both lines had a different theme and purpose. Indoors route gave an introduction how to use a walking meeting as a part of a working day and the outdoors route was built to support an actual walking meeting. Both lines took 15-20 minutes to walk and the length and types of routes were selected based on the users' expectation in the first study. There were also other options, but these two were selected for the study because they included the basic functionalities and ideas that we wanted to test during the study. We also had an initial idea how we thought

at the time a walking meeting could be started for the first time. The idea is presented in the picture below.

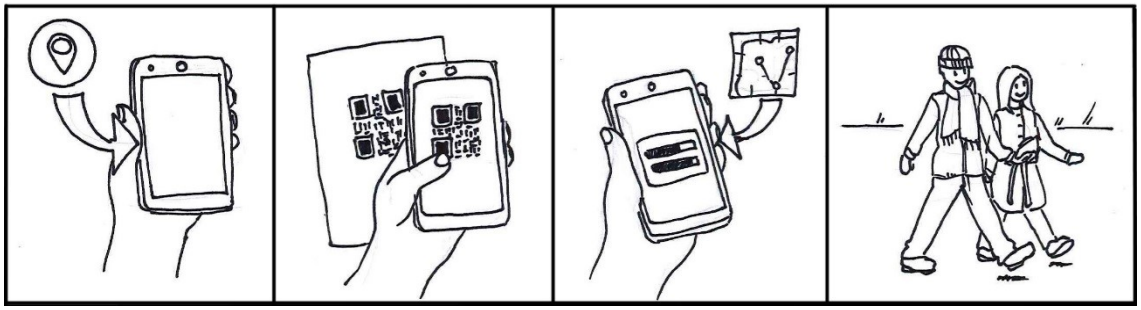


Figure 9. *An initial idea how the walking meeting could be started*

In the Walking metro study, we had 14 participants (F=10, M=4) in this study who all were knowledge workers from the Tampere University of Technology or from companies nearby campus. Participants were recruited were recruited through advertisement. The age of the participants varied from 26 to 57 years (mean = 35). Most of the participants exercised of had physical activity 1-2 hours/week and 8 participants used an activity tracker or application. Their work was also quite sedentary as the participants estimated that they were sitting around 80% of their working day.

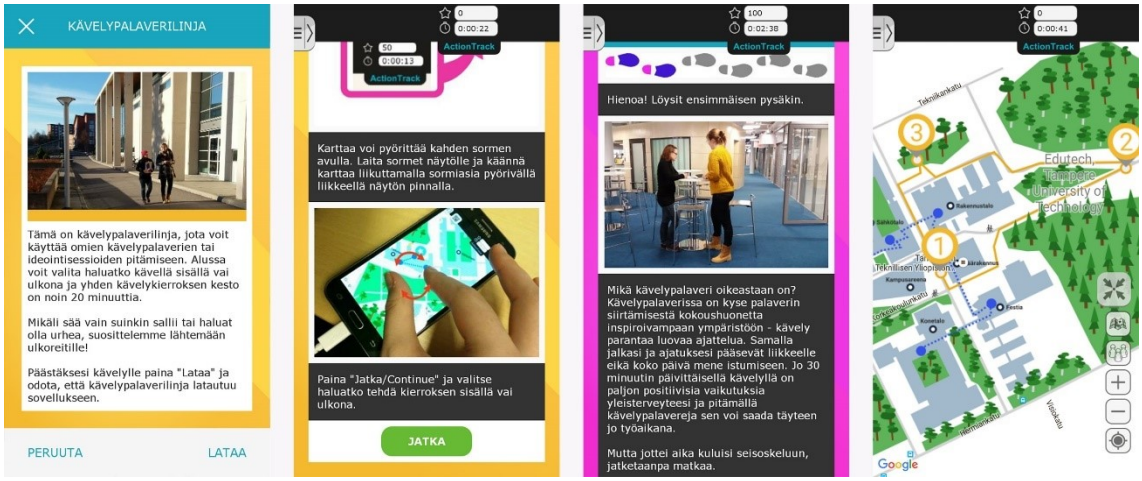


Figure 10. *Some screenshots from the Walking Metro prototype*

The study was conducted by walking in pairs and the participants were observed during sessions. The session started in the meeting room where the participants got background information about the study and they filled the consent forms and a background questionnaire. The actual walking session was divided in two parts: 1) testing the indoors route that introduced the walking meeting to the participants and 2) outdoors route that was designed for having an actual walking meeting. The idea of the indoors route was to learn about how easy or hard it was to find your way inside a building where GPS (Global Positioning System) does not work very well by only using map image and photo hints. We also wanted to see would the introduction to walking meeting work by having users to take a walk while they learned. The outdoors route part was all about the real meeting and the fact how well the Walking metro idea would suit for the walking meetings.

During the indoors route participants had a change to use the application independently and discover how the application and walking meeting works. After the first walk the participants also answered a few questions about initial experiences with the application.

Each outdoor walk was arranged as a real walking meeting, meaning that the participants used the application independently and discussed about a work-related topic with their pair during the test. During the test, participants were observed by two researchers and the discussion were recorded with audio recorder. In the end of walk they answered interview questions about the application and their experience. The interview questions included questions about following topics:

- How participants felt about the concept and the routes?
- What they thought about walking and having a meeting, overall and with the application?
- What kind of benefits they felt walking meetings could have?
- What kind of tasks they thought a walking meeting would be suitable for?
- What they liked and didn't like about the application?

The interview was a semi-structured interview and additional questions were asked when needed. After the tests, the audio files were transcribed and analyzed using affinity wall method. Affinity wall method is a method where that data is categorized and grouped in order to find out what kind of topics and observations can be revealed from it that are relevant to the design problems in hand. Each group should also describe a single point or an issue. (Holtzblatt et al., 2015) When building the affinity wall, the data from this study was compared and combined with the learnings of the first study.

The affinity wall diagram results were used for forming the ten design implications were formed. There was also a group of results that included wishes and ideas about application functionalities, and those results were used for designing the next iteration of the application and they are also used in this work. These design implcations were compared and used as a part of the "Walk as You Work: User Study and Design Implications for Mobile Walking Meetings" paper together with the first study results (Ahtinen et al, 2016a). Some of the results were also part of the papers "Brainwolk – A Mobile Technology Mediated Walking Meeting Concept for Wellbeing and Creativity at Work" (Ahtinen et al., 2016b) and "Let's walk at work: persuasion through the brainwolk walking meeting app" (Ahtinen et al., 2017)

4.1.3 Pilot: Brainwolk Experiences

Brainwolk pilot was the final study in the walking meeting project and it combined the results and learnings of the first and seconds study. The second version of the walking meeting concept was designed to be less interrupting than the Walking metro concept during the walk, the points were gathered automatically during the walk and it also offered more freedom of choice how participants wanted to do the walking meeting and where they wanted to walk.

The pilot lasted four weeks and there were 11 participants s (F=8, M=3) from university campus who used the application as a part of their normal working days. The participants were knowledge workers from the campus area and they were recruited via advertisements. Most of the participants used their own phone during the pilot but there were also two participants who borrowed phone because the prototype did not support Windows phones.

The goal for each participant was to take one walking meeting per week but there was no limit how many walks a participant should take or when the walking meetings should take a place. Each week participants received an email that would give them information about the points each participant had collected so far, a thought about walking and information about the weather during the next days. The scores and weather were shared with email because it was not possible to include there in our pilot prototype but we wanted to know did these factors motivate participants to take more walks. Overall the idea of the pilot was to give the participants the freedom to incorporate the walking meetings in their work as they wished and give them freedom to choose themselves how and when they wanted to take the walks.

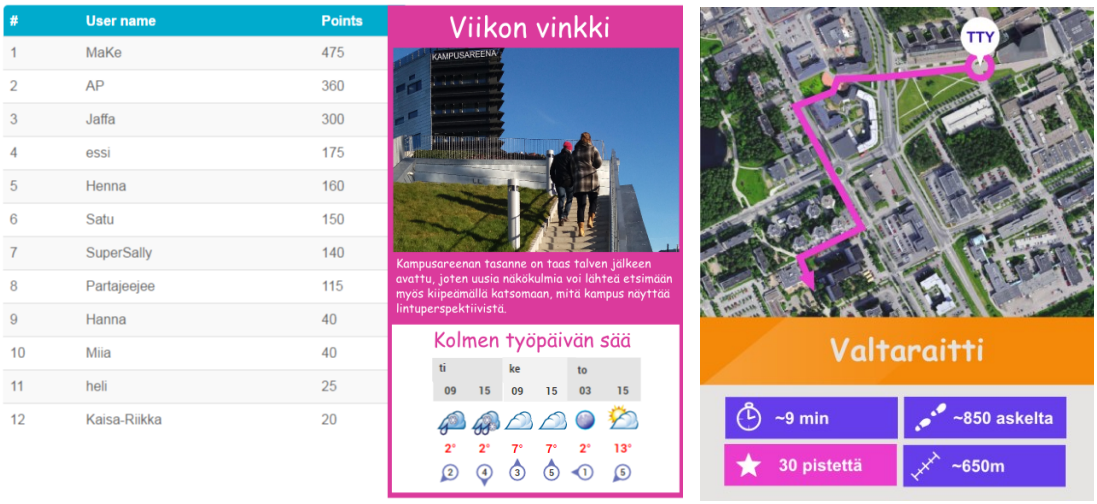


Figure 11. *On the left: Weekly message sent to users by email during the pilot. On the right: example of infromation offered to users about a single walking destiantion in the application.*

Participants took an online questionnaire before and after the pilot that included some background questions and AttrakDiff UX questionnaire (Hassenzahl, 2000) where they evaluated first the expectations towards the walking meeting app and in the end the walking meeting app itself by selecting between pairs adjectives in the scale of seven. During the four weeks each participant kept a walking meeting diary that included a pre-walk questionnaire about how they felt before the walk and after walk. The diary included a questionnaire and written diary where they filled in the feelings and thoughts. In the end of the pilot period, each participant was interviewed about the overall thoughts and feeling about the walking meetings and the prototype functionalities. The interviews were semi-structured interviews. Participants were also given a notepad that was suitable for taking notes during the walk to see if they

wanted to take notes on physical paper. Using the notepad was optional and the usage of the notepad was not especially encouraged.

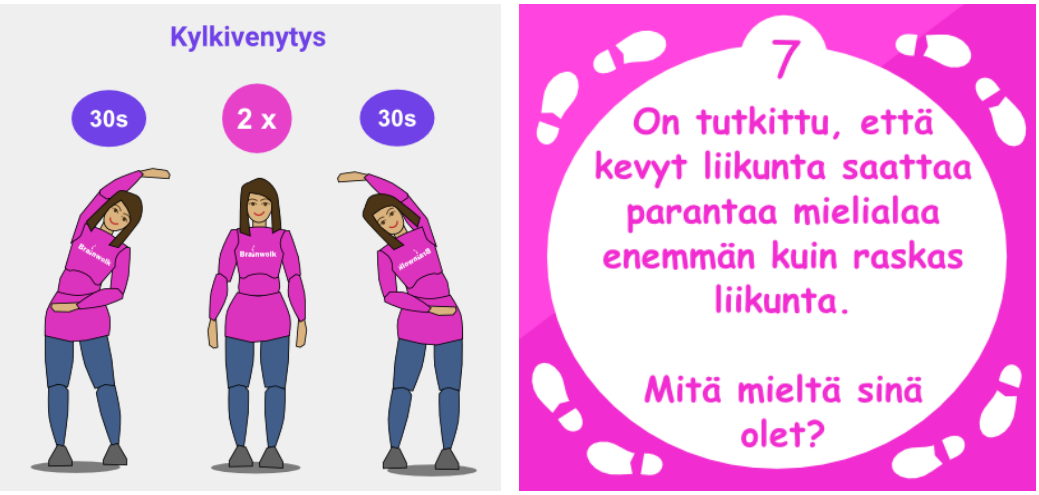


Figure 12. *Examples of reflective tasks and stretching tasks presented users during the walk on destination points. (Translation: It has been studied that light exercise can help improve mood more than exercising hard. What is your opinion?)*

The pilot prototype called Brainwolk consisted of a map view that included a set of destination pins. The idea of the pilot prototype was that in the beginning of the walking meeting, the user can open the map and plan the walking route by deciding to through which points they would walk during the walk. There was no preset routes and that way the user had a freedom to take walk to the destination any route they wanted and they also were able to put the phone in the pocket if that was preferable way to use the prototype. When any pinpoint on the map was reached, the user had an opportunity to check content (short physical exercise or a thought about walking, se Figure 12) that could be only activated on the actual location of the point. Checking the content was also optional and all the points of the walk were granted only by reaching the right location.

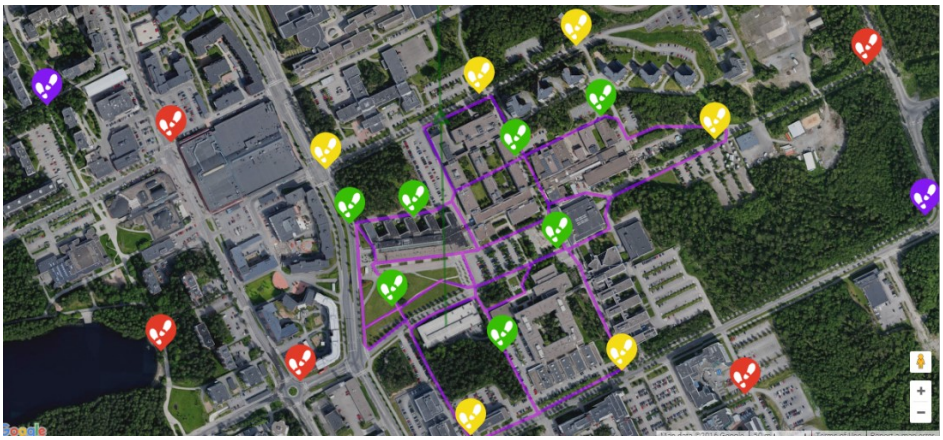


Figure 13. *A screenshot from the Brainwolk map and the destinations from the ActionTrack web tool.*

Participants were granted points for reaching certain GPS locations marked on the map. By taking a destination that was located farther away the user could also collect a greater amount of points. Also, any point could be collected multiple times, but all point had a timer that prevented collecting the points after a certain number of minutes after the point had been reached. The map and destinations can be seen in the figure 13.

4.2 Results of the three studies

4.2.1 Study 1: Results

In the first study we learned that only a couple of participants had tried the walking meeting and not all of them had heard about the walking meeting concept before. As a result, in the beginning when they were asked what kind of work related tasks they think they could do during a walking meeting, the responses at first in many cases were *"I can't think any tasks"* or *"I need my computer for everything"*. At this point some people very also more open to the idea said tasks like *"ideation at the beginning of the project"* or *"getting rid of the stress by changing the scenery"* or *"getting to know new working mates".* Some also suggested that they could take a walking meeting alone and for example listen to some work related ebooks or conference speeches. Overall, we also noticed that as we started the study inside in a meeting room, it seemed that people had more negative thoughts towards the idea of walking meeting. As we moved out and started to walk, the participants in general seemed to open more to the idea and got more excited to ideate. This also supports the other studies mentioned before where it seemed that walking boosted creativity (Oppezzo M. et al., 2014).

The main concrete findings from the first study were that:

- *There should be a clear route/routes to follow*
- *The routes should be designed so that they don't disturb other people*
- *There could be some meeting points where to stop if there are more than 2-3 participants in a meeting*
- *Some people preferred outdoor routes and some indoor routes*
- *The suitable length to a meeting can be anything between 5-45 mins*
- *The application should introduce the walking meeting to the new users*
- *The application could offer some to take notes, e.g. speech-to-text or by typing*
- *It would be good to think the goals of the walking meeting before the meeting*
- *There could be some advices and other content to support the walking meetings*

- *It would be nice to see data about the walks, e.g. lengths, steps, route etc. after the walk*
- *The application could offer some fun motivational tools, e.g. collecting points or having a high score board*

We also noticed that there are many factors that varied from person to person, and from position to position. For example, some people said that it is very important to them to take notes about the things they have talked about, and some said that they would prefer not to take any notes during the walk because it would interrupt their thoughts. Also, the time that a walking meeting could take varied a lot from person to person. There were also positions that included very few tasks that could be done while walking, and some people had a lot of ideation and thinking tasks that could be done also while walking. On the motivational part some people said that they would not like to have competitional elements in the app and some said they would like to have some. So overall, the expectations and needs varied, and we also tried to think about how to build a concept that would give people a freedom to select a suitable way to conduct walking meetings while guiding them and giving some motivation and fun content to them at the same time.

The Walking Metro prototype presented in the next chapter was also chosen from the idea that participants presented. It seemed at the time that a metro map would offer an interesting and familiar way to create different routes to the campus area. Also, it would allow to mix both indoors and outdoors routes on the same map, and give concrete stops where people could take some time to take notes or find additional information about the walking meetings.

4.2.2 Study 2: Results

Overall, this version of the walking meeting experience was not perfect even though we there were some successful elements in the application too. This was the part where we learned most of the requirements for the actual functionality of walking meeting application, and we also realized that not all the expectations and wishes were suitable for the walking meeting. Our basic concept idea of the points that a user can gather or access by using a smart phone was a good one but we also realized that you should not add too much extra content, information or notifications to interrupt the actual talking during the walk. Also, another important lesson was that it is easier to concentrate to the actual work topics if you don't have to navigate at the same time using the map all the time. Where the in the first study it seemed that people wanted to guidance and clear routes to the walking meeting, it started to also seem that the guidance should not be done during the walking and talking.

On the more positive side, the study also revealed a list of suitable tasks and benefits from the walk. The list of *suitable work tasks* for walking meetings included mostly tasks that require creative thinking or that were other ways generative, e.g. ideation and initial planning as well as thinking, reflecting, and discussing. Other tasks that were mentioned once or twice were familiarizing with new people, talking on the phone and listening work related podcasts or audio books. All in all, walking meeting

was seen suitable for informal meetings rather than formal meetings and it was notable that when the topic was raised for the first time in a group it seemed it was easier to think about why you could not go for a walking meeting. When the participants started to walk they were also more open-minded when talking about walking meetings and suitable tasks.

The most mentioned *expected benefits* of a walking meeting that were being active, being outdoors and feelings well. Participants said they also wanted to enjoy beautiful weather and fresh air as well as be able to experience nature during their workday. A changing view was also considered to offer variety and new stimulus to the brain and get new perspectives and more insight to their thoughts. Finally, as a result of walking participants expected to feel better and refreshed and to get a positive impact to the social interaction. These are factors that can be used to promote walking meetings but you they can be even more effective if people can experience the benefits themselves. These results seem to show that the concept of walking meeting itself was motivating and provided satisfaction and enjoyment to the participants.

Figure 14. *Weather conditions can also make it hard to use the application*

The study results also revealed some other challenges that users though would hinder or even prevent their walking meeting experience. The biggest challenge that participants mentioned was the current working culture and the fact that people are seen to be productive only if they are sitting in front of their computers. Even if the application alone cannot change the working culture it can offer an employer a way to permit employees to take a walk during a work day. Right now, the mental image of an efficient worker is a person who sits in front of a computer only taking the mandatory breaks and it is easy to feel we have no permission to leave our desks or to go outside. On the other hand, the application itself can act as a permission from the employer side when there us question whether or not you can take a walk during the working day. Other challenges were more pragmatic like how to take notes and what if I need a computer during the meeting. We didn't have an efficient way to implement a note taking tool in our prototypes during our studies and we finally decided to allow people to use any note taking method they liked which worked well. The

feature was although requested during each study so it will be part of the walking meeting application concept.

From the application perspective there was a long list of things to fix for the pilot and we aimed to design the next version of the walking meeting application to be less interrupting, to have more freedom to choose how to use it and to be more automatic than before. In the big picture the most important thing for the next step for the seemed to be to reduce the need of multitasking during the walk but still support the walking meetings both during and before or after the walk.

4.2.3 Pilot: Results

The pilot results gave us deeper knowledge about the long-term use of the application and how the users choose to combine the walking meetings to their working days when they had a freedom to choose the company and the place and time. We also learned more about the application and how well it was fitting to its task.

The background questionnaire revealed that participant's physically active time during the work day varied from 30 minutes to being active most of the time at work. Nine participants did some physical exercises outside of the work time 1-3 times per week and 2 participants exercised more than 4 times per week. Six of the participants used an activity tracker apps or devices such as Sports tracker or heart rate monitor. Seven participants had some previous experiences of walking meetings.

During the pilot participants took 43 Brainwolks in total which also means one Brainwolk per participant per week. In practice each participant did 3 to 5 Brainwolks during the pilot. Typically, Brainwolks included two people but some participants tried the walking meetings in bigger groups (3-10 people), and some tried the walks also alone. We also learned that Brainwolk can take many different forms and it is a flexible tool that can be utilized for different tasks including ideation, looking for new perspectives, refining ideas, making summaries, and also about sensitive topics. The diaries also showed that in general participants had more positive overall feeling than before the walk.

The interview results as well as our end questionnaire showed that the application itself still needs some iterations to support the walks better. From the positive side, seven participants said they liked the idea that they could plan their route before the walk, and also plan how to get most points during the walk. That was a clear improvement to the previous results where the users had to follow the guidance from the app during the whole walk. The app was also seen useful source to get tips and hints about how to conduct walking meetings. Another positive aspect was the social pressure to take walks when they saw the leader board once a week in email. Not all participants liked the competitional aspect but some clearly liked it.

On the side that was not that successful, the participants noted that the app itself was not motivational enough as it was. The checkpoint content was not meaningful enough and they were seen as interruptions when activated. Overall using the application during the walk took the focus too much away from the walking itself. The

interviews also showed that the checkpoint notification vibrations were disturbance during the discussion. Also on this study users asked for a note taking tool to be implemented in the application. Also, as the AttrakDiff questionnaire shows in the figure 15, the application was mostly average and didn't get very positive or very negative scores.

Human (1) - Technical (7)	M=4.5, SD=1.0
Pleasant (1) - Unpleasant (7)	M=3.4, SD=1.2
Practical (1) - Impractical (7)	M=4.7, SD=1.1
Likable (1) - Disagreeable (7):	M=3.7, SD=1.2
Cumbersome (1) - Straightforward (7)	M=3.6, SD=1.3
Rejecting (1) - Inviting (7)	M=4.3, SD=1.0
Dull (1) - Captivating (7)	M=4.3, SD=1.3
Motivating (1) - Discouraging (7)	M=3.4, SD=0.8

Figure 15. *Users' mean responses and standard deviations (N=10) to the AttrakDiff statements about the UX of the Brainwolk app, filled in on the final online questionnaire (scale: 1-7). (Ahtinen et al., 2017)*

All in all, the pilot results showed that the walking meeting application should be designed as a standalone application rather than using existing tools in order to implement all the features that users wish for in the most suitable manner for walking meetings. The pilot also made it clear that interacting with the application during the walk, at least constantly, is not wanted. This means that the interaction should happen mostly before or after walk and the application should support the walking for example by offering help to the route planning or by giving tips how to combine walking with different types of tasks. Also, the application needs more motivational features or elements, but they have to be designed so that they are not mandatory to use and the users can explore and pick the tools themselves.

4.3 Summary

Overall the three studies showed that people enjoy taking walks during the working days and taking a walk has its benefits in certain work tasks, e.g. ideations, refining your thoughts, making time for more personal meetings, going through confidential topics, etc. It was also clear that walking a walking meeting app has some special work-related requirements in comparison to the plain physical activity or sports app. For example, where the initial idea was that the walking application should be fun and maybe even game like during the walks, the final result was that the fun and motivation should happen before or after the walks. Also in the beginning the idea was to offer predefined routes for the walking meetings but after the Walking metro study we realized that following a route takes too much attention and it is better just to decide a destination before the walk.

Based on these studies, the most challenging part of designing the final application concept will probably be to keep the users interested long enough that they start to form a habit to walk. It is not necessary that the users keep using the application

forever, it is more important that they have enough time and walking meeting experiences to see how the walking could be incorporated in their work. It is also important that the users think about how they feel after and before walks so they get the idea how walking affects their overall feelings and energy levels. In short, the purpose of the application is to give the right tools for a user to get the optimal and good walking meeting experience and the knowledge to modify the walking meeting to suit for the user's work and tasks. As the actual positive experience will come from the walking itself, the application itself should work more as a supportive tool than an entertainer or a game.

5. DESIGN GUIDELINES FOR WALKING MEETING APPLICATION

This part of the work answers to the first research question *"What makes a walking meeting application different from other mobile applications?".* Overall, the walking meeting application combines physical activity and working at the same time, and that is the factor that also makes this application different from other physical activity measuring applications. During our studies we discovered similar requirements in comparison to the current existing physical activity trackers but there were also differences. Most of the differences are related to working and walking at the same time, and the motivational elements of the application and how they can be utilized during the walk and work process. As the users are required to concentrate on the conversation during the walking meetings, all common regular motivational methods used in physical activity applications cannot be applied to the walking meeting application. On the other hand, all the basic and common user interface design principles should be kept in mind in the design.

The following guidelines are based on the three studies presented in the chapter 4. The studies we made in comparison to a set of other similar guidelines provided a good base to evaluate which parts of our results are related to general UI design guidelines and which are more unique to the walking meeting and work-related application. For example, if some functionality was hard to find or understand, the problem was more about usability than walking meeting application related issue. On the other hand, the participants keep asking for tool to make notes, and that on itself is a walking meeting application related issue. The guidelines presented in chapter are the ones that were particularly related to walk and work context and they should also give an idea how user want some particular features to be implemented in the actual application.

5.1 Guidelines

According to our studies, the walking meeting concept is different from other application because it is both work and physical activity related. In many cases work related software is used on table top computer or on laptop while sitting on standing. The work-related application are also usually tools that help us to perform a certain task, e.g. to write a document, send an email or calculate some numbers. In the case of walking meeting application, the idea is to help users to include physical activity in their working day and move while they perform work related tasks that don't necessarily require any additional tools, like computers or other physical tools. The idea is that users would learn what tasks really need to be done sitting in front of the computer and what tasks allow us to leave workstation. There are also tasks that can be divided into parts so that a part can be done while walking and the rest on the computer.

On the other hand, the idea is to motivate and help people to change their way of working and shift their working habit towards more walking and less sitting. Even if walking all the time while doing knowledge work tasks is not possible, it is important to find ways that allow people sit less at work. That is something that the walking meeting application can help people with.

These guidelines give practical hints what kind of features and content users are expecting from the walking meeting application. The guidelines also give a basic idea how to approach the motivational part of the application for boosting physical activity at working environment. Even if the studies that were done focused on walking meeting, the results can be used as a basis for other similar application to give a basic idea what kind of factors should be considered in this kind of application.

The guidelines were formed by combining and comparing the results of the three studies and by considering the previous guidelines that were published based on our study results. The four-week Brainwolk pilot and the Walking metro prototype study provided most of the information to form the guidelines but some functionalities, like e.g. note taking tool, were wished throughout all three studies. The guidelines are based on the user's needs and the information users provided us during the studies, and also on the observations we made during the studies and from the gathered data. The Self-Determination Theory and the Persuasive design learnings provided information to the forming the of the guidelines as well by helping to focus on the right kind of motivation and focusing on the right ways to motivate people.

Initially there was set of eight guidelines but as the work progressed the guidelines went through some iterations as the knowledge and more holistic view of the application and study results were formed. The goal was to include the most important functions and features that users felt were needed and that were useful or motivating in our studies in these guidelines. The content of the guidelines remained around the same but the expression was defined and some guidelines were divided into two. In their final form the guidelines include ten individual instructions that are the following:

Guidelines for motivational and persuasive physical activity application in work environment:

1) Give introduction and concrete examples how to combine physical activity and working
2) Provide reminders and guidance
3) Offer efficient and suitable tools for the work tasks
4) Keep the interaction while physical activity optional
5) Automate data collection and provide meaningful key metrics
6) Include different motivational elements for different types of users
7) Help users to plan and set the goals
8) Offer voluntary social and competitional features
9) Reward users when they meet their goals or achievements
10) Help users to reflect the benefits of physical activity

5.1.1 Guideline explanations

The guidelines on their own may not offer enough information how to use them in practice. The guidelines here are divided into two categories. The first five guidelines are about *supportive features* of the application that will help the users to have successful walking meeting from the beginning. The last five guidelines offer information about *motivational and persuasive factors and features* of the application. Supportive features are there to provide information and help users to do the walks, in this case walking meetings, and the motivational and persuasive factors and features are there to help people find the joy what they are doing and keep them coming back to the activity.

Supportive features

1) Give introduction and concrete examples how to combine physical activity and working

Even if the idea of walking meetings and other interventional physical activities are familiar to many, most of the people don't know how combine work and physical activity. Give them a good introduction how to do things and how to apply the physical activity to different kinds of work tasks. That makes it easier to apply a new habit into an existing routine without a need to think how to do things.

2) Provide meaningful reminders and guidance

It is important to remind people to act or help them take the steps towards the new habits. In concrete level guidance can be either verbal or showing people where to walk via map, depending of the situation and activity. But when designing this kind of features that can interrupt for example discussions, it is very important to try to remind and guide only minimum level and do it when it is convenient for the user. In work environment less interruptions will have more impact.

3) Offer efficient and suitable tools for the work tasks

If users will leave their desk or office to do some work tasks, they in many cases feel that they need some tools with them. Taking laptop or pen and paper may be too much in addition to mobile phone, so it is necessary to offer the needed tools inside one application. For example, in the case of walking meeting application, many people wanted to have a tool to take notes during the walk. Also, the overall concept of meeting usually gives an impression that you need to take notes.

4) Keep the interaction while physical activity optional

When people are in the move and trying to concentrate on working, interaction with the mobile phone will usually take their attention away from the thing they are trying to do or solve. The application can offer interaction possibilities while activity, like setting destination or suggesting some additional activities, but all of them should be

voluntary. It is usually better to give feedback or offer content before or after the walk. For example, walking meeting application can offer some suggestions about walking destination before walk and show statistics after walk, but it is possible to access both during the walking if needed.

5) Automate data collection and provide meaningful key metrics

As mobile phones have good features to track user's movements and activity during the whole day just by asking permission to gather this data, it can be ideal to automate these kinds of data gathering features. As many people already use some kind of activity tracking app or device, it can also be a good idea to see if you can import data from other trackers, so users don't need to have multiple trackers. If you want to specifically track activity during the working hours separately, you can also ask people to define their working hours when they start use the application. For example, as the walking meeting application's idea is to help people to learn to apply walking meetings as a part of their work, it makes sense to focus the tracking and metrics to track the working hours.

Motivation and persuasion

6) Include different motivational elements for different types of users

It is hard to define one single thing that will motivate all the people and all the users, so it is important to think about what kind of different features it is possible to offer for different people. Next four guidelines will offer some idea what kind of features there can be, but there might be different motivational elements depending on the physical activity. As the walking meeting studies showed us, some people like competition and some just want to learn or have new experiences. For example, the walking meeting application is for knowledge workers, but there are so many different people that work in this position, it is not possible to define one or two motivational features that would suit them all.

7) Help users to plan and set the goals

When learning a new habit, it is important to make a concrete plan and set some realistic goals in the beginning of the journey. For example, deciding to take a walking meeting once a week for four weeks, may give the initial impact for the change and be realistic goal at the same time. It is possible to help user to do this by giving advice and offering different options how to set goals. It can be also a good idea to guide users to set easier goals at first and give them options to challenge themselves when they have learned the basics. If the goals are too hard or unrealistic at first, it is also easier to give up.

8) Offer voluntary social and competitional features

Some people enjoy doing things in social way, by following others progress or competing with them. On the other hand, this kind of features cannot be mandatory for all the users, since some people want to keep thing private or they don't like competing with others. For example, in walking meeting studies some people wanted to

make us many steps as possible but some didn't feel the need to see the "high score steps" list at all, and especially the competition seemed to be a topic where some people liked it and some people did not. On the other hand, it is important to remember that the social features don't have to be competitive at all. Sharing nice moments or pictures can create a feeling of nice community and motivate people to share their moments.

9) Reward users when they meet their goals or achievements

When people reach their goals, it is a good idea to give them some kind of reward. It can be a notification that congratulates them or the application can give them an achievement. Achievements also offer a possibility to give users surprise rewards, for example for using the app for the first time, or doing the new activity once in every day of the week. Further on, allowing users to scroll through the unlocked achievements can give them ideas or motivation to do the activity more to unlock some specific achievement.

10) Help users to reflect the benefits of physical activity

It is important to help users feel and understand how the physical activity is beneficial to them. To help the users to reflect how they feel before and after the activity, will also help them boost the internal motivation to keep going. Overall any physical activity is usually beneficial to us, so it should also make us feel better, and it is important that people also recognize it. For example, in walking meeting studies people felt usually better and more energetic after walks, and that itself is a very good reason to keep going and that is the initial goal of the physical activity overall. People also realized consciously that they were actually feeling better when they were guided to think about it.

5.2 Summary

These ten guidelines will offer a good basis for designing a walking meeting or some other physical activity application in workplace environment. These guidelines will meet the need of a good walking meeting application but when it comes to the other similar applications all the guidelines may not be relevant. For example, the last five guidelines can be used for many kinds of motivational applications, not only physical activity applications.

Overall all, both practical and persuasive features are needed to be considered because any motivational application consists of a set of practical features that make the usage of the application easy and efficient, and set of other features that are designed for motivational purposes. Even if the motivation and persuasion is the central purpose of this kind of application, the user interface design and user experience should be also considered carefully. If the more basic features are not functional and satisfy users, the motivational features don't have the change to help users.

Even if these guidelines cover some of the practical features and a wide variety of motivational and persuasive viewpoints, it is still important to do user studies, take

a look at other more general user interface design guidelines and get to know the most common motivational theories to design the features the best ways possible. As the guidelines only give an overall impression what kind of features and motivational elements users may expect from the application, it will be important just use these ten points as they are – guidelines that can help you make design decisions in various stages of design process.

6. CONCEPT DESIGN

This chapter will answer to the second research *question "What kind of features and functionalities support and motivate users in a walking meeting application?".* The features and other functionalities presented in this chapter are mainly based on our study findings. Overall the walking meeting application is somewhat novel application idea in the field of work related applications and also in the field of activity tracker applications. For example, the most popular activity tracking systems used for measuring activity during physical exercises or to measure overall activity during the day do not offer sufficient features for walking meeting purposes. Even if it possible to see or measure your activity during a work day by using these more general applications, they don't offer any special features for physical activity at work or features that support doing the actual work.

There are also some features included in the concept that could not be tested during the studies and the pilot. Even though ActionTrack provided a solid base for most of the ideas related to the topic it was not possible to implement all the elements that were requested from the users or that we would have liked to test during the research. For example, making notes during a walk and sending them after the walk to a user's email were requested features but there was not practical enough way to implement these features. That is also one reason why we wanted to present a concept that would include all the elements we found to be necessary for an application in a form of a single concept that is dedicated to the walking meeting purposes.

6.1 Users and context of use

This subchapter presents the user groups and the context of use of the walking meeting application in a summarized form. The descriptions are based on the things that were learned during our studies and they give a general idea what kind of users and context of use the walking meeting application will have.

Users

The target group for the application is knowledge workers who are mostly sitting in front of their computers or in the meeting rooms during a work day, and who are somewhat interested to sit less at work. The knowledge workers can be at any age from around 18 years up closing to the retirement age. They also can have very different physical health or fitness level, and their interest towards sports can vary widely.

Figure 16. *Example of knowledge worker at her work - Photo by Tran Mau Tri Tam on Unsplash*

The user have to be divided into smaller target groups as the overall group of knowledge workers is quite broad and it includes many different types of people whose motivation level and interest towards physical activities at work and on free time vastly vary. One way to divide these people in the smaller groups is the *level of interest and motivation* they have towards trying the walking meeting application. From this group of people, the most likely early adopters for the walking meeting application are the ones who are have the interest to include new ways of work in their everyday life and have a high of motivation to include more physical activity in their working life as well. If these people successfully adopt the new way of working, other with less interest and motivation can also find interest to try walking meetings and walking meeting app, and the early adopters can act as walking meeting tutors for others. There will also be knowledge workers who are not motivated to change their ways or they don't see the need for change, and they may resist the idea and may resist the whole idea of walking. It is important to not to force these group of people to participate or walk if they don't want to.

Another way to divide the wide group of knowledge worker into groups are the *matters that motivate them* and how they can be motivated via the walking meeting application. In the studies there seemed to be people who liked the competitional aspect of the walking metro prototype. On the other hand, some people seemed to get most from the good feeling they got from the walk or the fact that they got some things done that otherwise usually got postponed time after time. It was also clear that some people enjoyed the social aspect of walking and walking meetings. Regardless of the motivation level of each user, they also have different preferences what makes them feel motivated or joy. That is also why application needs to include different motivational features.

Context of use

The other factor along the users that should be considered when designing the application is the context of use from the physical, temporal, cultural, social and technical perspectives. As the physical context for the use is the working environment, the application should function in the manner that supports the work. That means that the physical context relates quite closely supportive feature guidelines presented in the previous chapter, and the application cannot cause too much disturbance but offer support and motivation at the same time. The temporal context is also closely related to the physical in the way that the application is designed to be used during the working hours, even if it can track the activity also outside work. It is important that the support and motivation happens during the working hours and not outside so that the motivation is timely and meaningful for the users.

Figure 17. *On the left and center: typical office settings. On the right: walking meeting context.*

Also, the cultural and social context are close related in the work places. On the higher-level, work place culture can be supportive or restrictive to new ways of work. If the work place culture sets strict rules how people should work and does not offer much freedom, being able to do walking meeting may have higher impact on people than in the place where ways of working are freer. The social aspect in the working place is also different than it is our free time. To take a walking meeting you usually must walk with the people who work in the same project or around the same things as you are. That means that you are not free to choose anyone to walk with you. You also may have to agree the topic and schedule of the walk beforehand.

Finally, the technical perspective has its own possibilities and challenges. At the moment, at least in Finland, we have three mobile platforms that employers provide for their employees. As Android and iPhone are quite standard platforms all around the world, in Finland we have also many Windows phone users. At least at the time when the study was made, the Windows phones were one of our problems. Now that the production of the Windows phones has ended, it is likely that this problem is smaller than it was before.

Developing both Android and iPhone set their own requirements for the design though on their own. For example, there are several ways to develop one application to the both application and both platforms have their own design guidelines. When starting the user interface design, it is important to know what kind of technology is used for developing the applications and decide what are the most important things that should be used in the design from the platform specific design guidelines. These kinds of things can be the location and functionality of menus or the way user can go back to the previous screen.

6.2 Application and features

The walking meeting application concept and features were formed based on the Walking metro prototype results and the Brainwolk pilot results, and the relevant parts of the first Users' expectations study were also compared and considered in the design. The guidelines provide the base for the whole concept itself and the goal of the concept is that the application and the concept includes all the elements presented in the guidelines. In this concept design the user interface design theory part provided ideas how to implement the design in concrete screens of the application and the motivational theories and persuasive design helped with the design decisions when considering how to implement different motivational and persuasive elements.

The structure of the application, the order of the different views in the application and placement of the functionalities inside the application have evolved during the design process. The initial idea was that the application would always start from the map view but during the process the results indicated that the map was not the most important part of the walking meeting application. The initial idea also concentrated more around the guiding a single walking meeting but even if users liked the idea of planning routes in advance, it was not the central part of the application either. The final design lands to a more general overview page and provides more concrete advice and tips to do the walking meetings and it supports users to do walking meetings continuously rather than concentrating on the performance of a single walk.

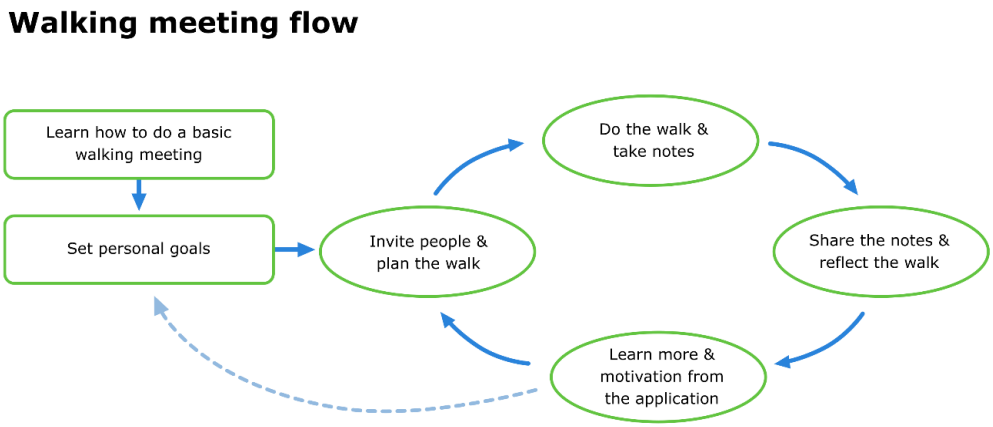


Figure 18. *Walking meeting flow from the user's perspective*

The walking meeting application features are divided in two categories that have the same names as the two categories of the guidelines: supportive features and motivational and persuasive features. To help to understand the application features and structure better there are also the walking meeting flow from the user's perspective and the actual application flow first in this chapter. The walking meeting flow from the user's perspective is presented in the Figure 18 and the application flow in the Figure 19.

Walking meeting flow is the path users will follow when taking walking meetings. This is also the flow that application itself should support and provide users the tools to learn and follow the steps on this this flow. The overall idea is that the user should first learn the very basic things about how to do a walking meeting and then do a personal walking meeting schedule and plan to set some goals. After that user is ready to take the first walk and invite someone to have a walking meeting and plan the walking meeting topics, either by using the application or some other methods. Next user will take the walk and do the notes, either during or right after the walk.

The notes can be taken by using the app or by any other method user prefers. Then the notes are shared and it is also time to reflect the walk to learn how it affected the task and the overall feeling. Between the walks users can learn more about how to take the walks with different tasks and find motivation from the app. At some point users will also reach the goal they have set and at that point it is also time to set new goals. All in all, it is not mandatory to use the application during all the steps of the walking meeting, but the features are included in the application to help users find the ways they prefer to do a walking meeting.

Application flow

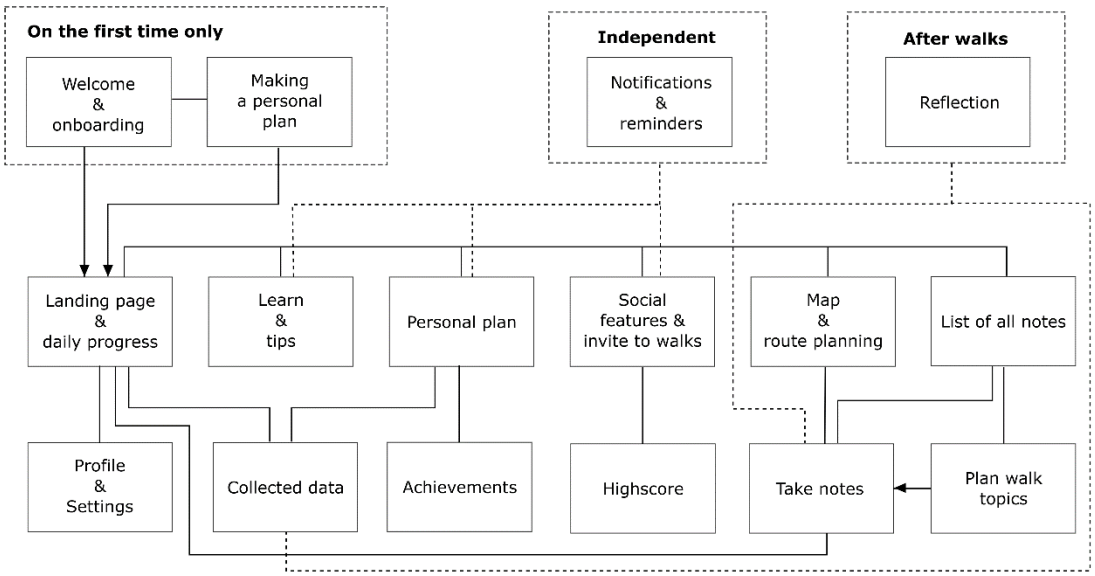


Figure 19. *Application flow chart including different features*

The actual application flow consists of onboarding screen and setting the goals, landing page, planning and note taking tools, personal goals and other achievements, a map view to help with route planning, notification and reminders, automated data gathering, and in-app social features combined with competitive elements. These features are designed to cover the walking meeting flow presented in the Figure 18 and this application flow also includes all the supportive and motivational and persuasive tools that are needed for the walk.

The application screen pictures presented later under the Supportive features and Motivational and persuasive features chapters are still on the concept and prototype stage and they do not visually represent the application in its final form. The screen pictures are included in this work to give more concrete idea of the features and as examples how they could be implemented in the application.

6.2.1 Supportive features

The supportive feature of the application are features that offer necessary practical tools that are needed and wished when people are taking a walking meeting. The supportive features are:

1) Starter guide and walking meeting tips
2) Planning and guidance with the map
3) Walking meeting content planning tools
4) Note taking and sharing tool
5) Automated data collection and permission asking

Starter guide and walking meeting tips

Starter guide and walking meeting tips features provide information about basic principles of the walking meeting idea as well as concrete examples how to apply walking meeting with different types of tasks. Walking tips can also give ideas what kind of tasks work go well together with walking meetings to give idea of variety of ways the walking meetings can be done. Starter guide (Figure 20) and walking meeting tips (Figure 21A) can also offer information about how to plan your walking meeting, how long a walking meeting usually takes, how to decide the route, how to take notes, benefits etc.

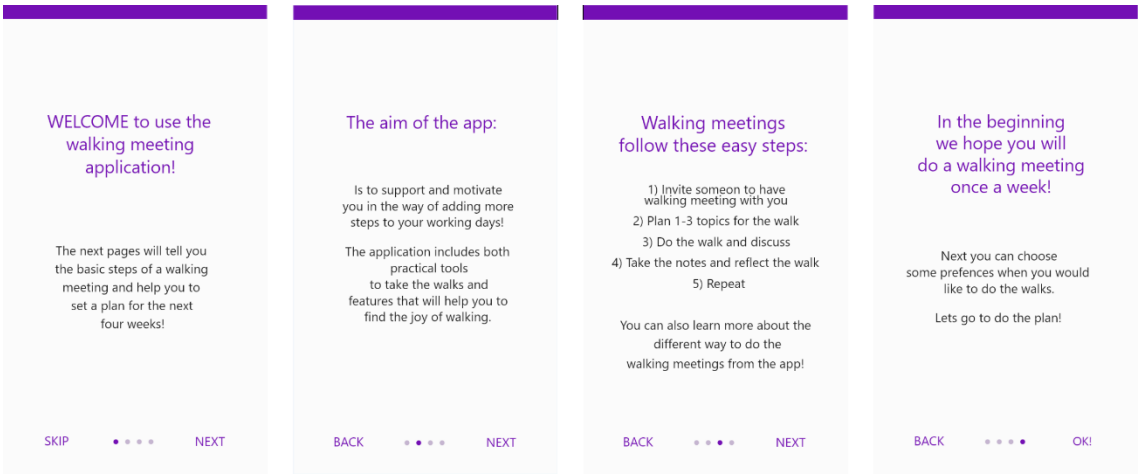


Figure 20. *Example of the starter's guide: application onboarding steps*

In our studies the participants liked the guiding and tips and they are also necessary in order to people to learn about the walking meeting and that they learn to apply them in their own work the best way possible. Learning about the method can also support the sense of competence and autonomy as users will learn to do the walking meetings better on the way, and this can help users to feel more motivated. Learning and mastering and adapting the walking meetings to the work can be rewarding and it is important that people have an easy access to the information they need to do the walks.

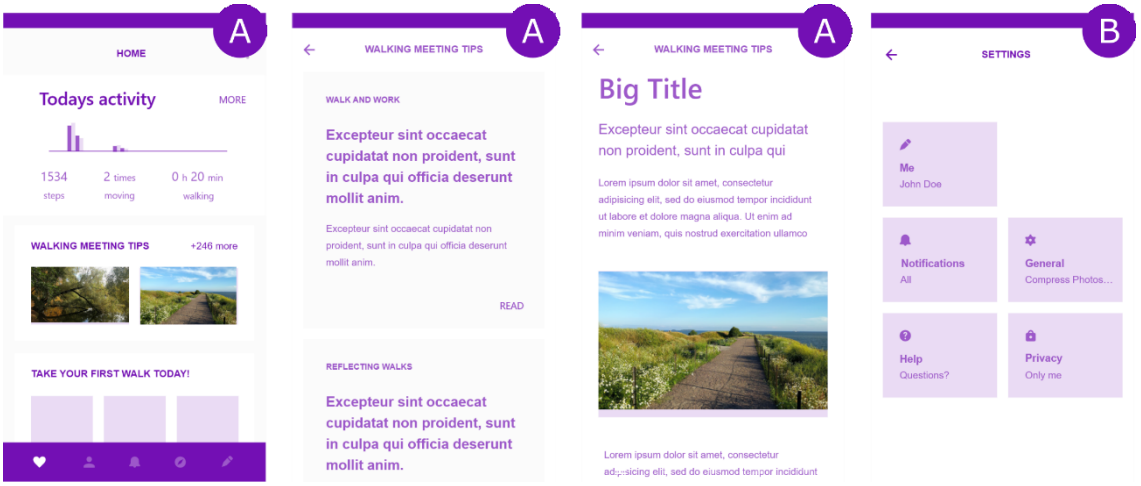


Figure 21. *A) Walking meeting tips views B) Application settings*

In practice user will get a short onboarding information package when they first start the application about how the application works and what it is about. The most part of the walking information will be stored in its own category in the application and users can access it anytime they want to. The application can also give some notification based hints for example once a week from the information library. These topics should be picked carefully and try to give users information that is meaningful for them and give them new ideas about the walks based on their current level.

Planning and guidance with the map

The idea of planning and guidance with the map is that users can choose their route before the walk based on the referred points on the map. In the case of Brainwolk pilot prototype, the points on the map rewarded users score that was seen on the high-score list and the points also included optional content that could be accessed on the specific location. As the users didn't feel that the content on the locations was necessary, the final application only includes the score gathering feature.

The points on the map can be generated randomly (Figure 22A) or they could be places that users have promoted themselves. As users tend to plan their routes so that they can increase their score as much as possible, the distance and scattering of the points can be designed based on that idea.

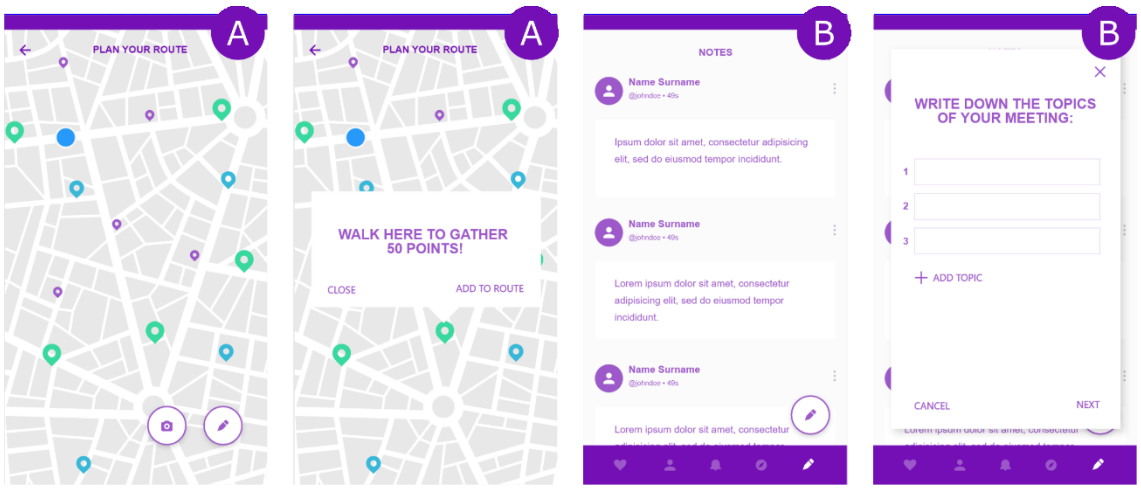


Figure 22. *A) Planning and guidance on the map B) List of taken notes and planning walking meeting topics*

As the planning of the route before the walk seemed to work well in the pilot instead of following the route on the phone, the map should also be easy and fast to access. It is also ideal that the user starts with the fewer points on the map in the beginning and they will get more points as they progress. The points on the map can be tied to the user's score, achievements or the goals. Revealing new or changing destinations can also help users to keep doing walks and stay motivated through exploration.

Walking meeting content planning tools

Some participants in our studies told that they would like to plan the walk content and topics before walk and have a list of topics with them on the phone in the application. This feature is closely linked to the next feature "Note taking and sharing tool" as it would be most efficient for the overall usage to combine the structure planning and the notes in the same view.

In practice, the planning of a meeting would happen by simply listing the topics of the walk (Figure 22B). Optionally, the user could decide the desired duration of the meeting and select the reminder to change the topic so that each topic has the same amount of time. Planning the walking meeting is also partially linked to the social

aspect of the application and the user would be able to share the topic list with other participants inside the app or externally by email.

Walking meeting content planning tool would be overall be optional feature to use, and it may not be interesting or necessary for all the users. As some people felt very strong need to have notes and way to remember the meeting topics, the feature is included in the concept design.

Note taking and sharing tool

Note taking tools were one of the most requested walking meeting application feature. One reason for that possible is that we were not able to implement the note taking tool in our prototypes because the prototyping tool did not offer solution to that feature. On the other hand, taking notes is an important part of meetings, and it is expected part of any meeting, done in a meeting room or by walking. That also means that taking notes is part of our mental model of the meeting and expected to be part of such.

The note taking tool in this application will work on its own during any walk or together with the topics listed before the walk during the planning phase. If user only want to take notes during the walk and does not feel the need to plan walks, taking notes should still be possible. The notes should be also able to be written after the walk and shared to other users inside the application or via email. Using this feature is also optional and it is not required to be used in order to take walks.

Automated data collection and permission asking

During our studies people felt that the application needed overall too much attention, and as it is possible to automate the data collection it is one of easiest way to take the load off from the users. Automated data collection is also the most common way to track steps and overall activity in different kind of activity trackers both on mobile and separate devices. That means that user does not need to start or stop the data collection when the activity starts.

In this application the most important part of the physical activity tracking is during the working day. The application can track data also on the free time but the analysis and progress should be done from the data that has been collected at work. The most interesting individual metrics are the steps, the walked distance, the intensity of activity and how many times walking has happened during a work day (Figure 23).

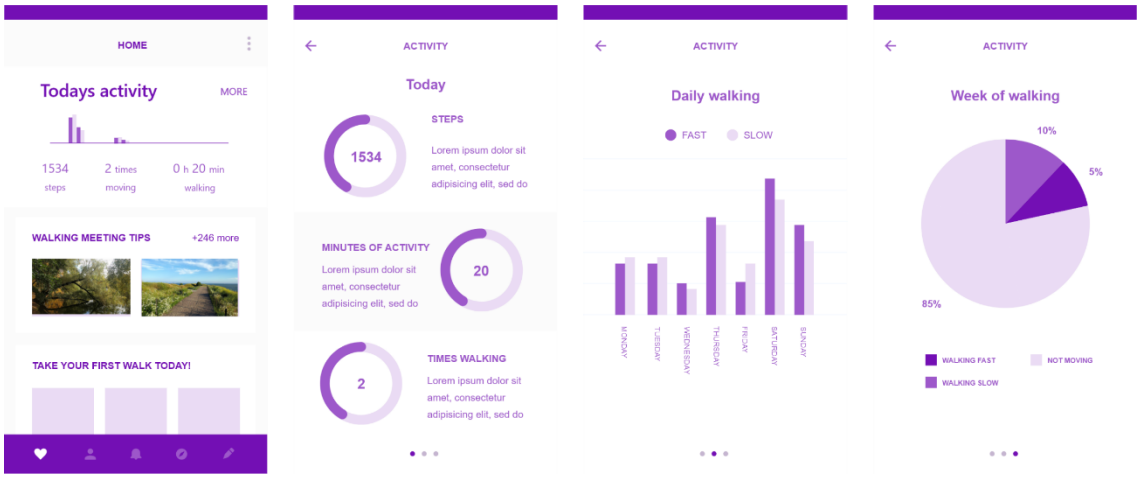


Figure 23. *Automated data collection and progress follow up*

Data collection is at the moment very sensitive topic and there are new laws coming up that regulate data collection, what you can do with the data and how you have to store it. That why it is also important to inform user what kind of data is collected, how it is used and who has access to the data. Users should also have possibility to erase all the collected data if they want to and prevent the data collection if they want to.

6.2.2 Motivational and persuasive features

Motivational features are the parts of the application that will persuade the users to take the walk and offer motivation to keep on going. The motivational and persuasive features are:

1) Personal goals and follow up
2) Notifications, reminders and reflection
3) Achievements
4) Social walking meeting features
5) High score list for grouped users

Personal goals and follow up

To form a new habit and change our behavior it is necessary to create a concrete plan and goals to for the new activity. That is also why the walking meeting application includes tools to plan personal goals and help users to follow them through. It is also important that first the application suggests sensible goals (Figure 24), like one walking meeting a week. Goals must be at the same time realistic and rewarding when they are reached. For example, the first goal could be simply “Take your first Walking meeting”.

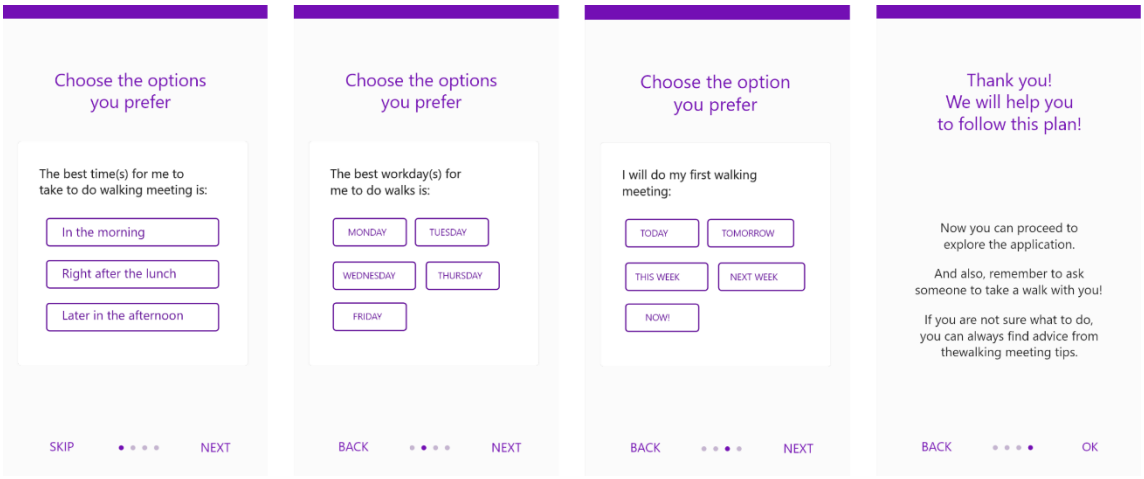


Figure 24. *Example of the setting up personal goals in the beginning of the application*

The personal goal means that you will select how many times per moth/week you want to have a walking meeting, the setting would you rather walk in the morning, mid-day or afternoon. The user could also select a weekday or weekdays when the walking meeting would be most likely possible. The application will build a visual plan for the user where the progress can be followed.

Notifications, reminders and reflection

Sending the right kind of notifications to the user at the right moment is a hard thing to do. In the case of walking meeting application, the notification and reminders are based on the user's own plan and goals and the idea is to support users in order to reach their goals.

The user could for example be notified on Monday morning that they could arrange a walking meeting on Thursday afternoon (Figure 25B) because it is a preferred day and time. Another example of notification in the sense of reflection could be that after a walk and ask users think about how they feel after the walk, in comparison to how they felt before. The overall goal is to send less notifications and make them more meaningful and not just get users attention.

Achievements

The application includes also achievements (Figure 25A) that are not related to the personal goals. The idea of the achievements is that people can see the list of achievements in the application and try to reach these goals as well as their personal goal and help them keep going and get coming back to the walking meetings.

Some examples of achievements are taking the first walk, taking 5 and taking 10 walks, inviting someone to a walk using the application, taking a walk twice during the same week, walking certain amounts of steps, reaching your personal goals and so on. The achievements can also be silly like walking when it rained, being a book worm for taking notes, being a steady planner for planning the meetings, having walk on the same day 4 times, and other more random goals.

Setting some readymade goals that can be seen as list may help users create internal goals, and as some achievements may be triggered as an element of surprise, they will also serve as surprise rewards and visualize that the progress is happening all the time.

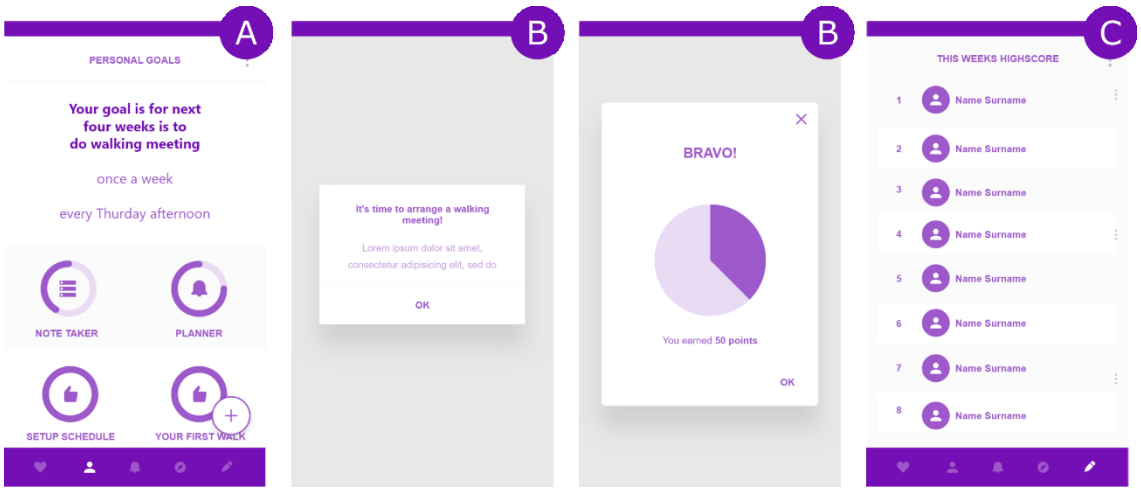


Figure 25. *A) Achievements and personal goal B) Notifications and reminders C) Social high score list*

Social walking meeting features

Many people liked the social aspect of the walking meeting, and the walking meeting application can also work as internal tool for the bigger change in the organization. The idea is that the employer adds users/employees to the organization's group that will share the walking data with each other.

The users inside the same organization can also invite each other to take a walk inside the application. In other words, the walking meeting application would also be a social platform for walkers. This feature will also help with the problem when people are not sure can take do walking meetings at work. If employer gives the walking meeting application to the employees it is a clear message that the walking is allowed.

This should not be a restriction to use the application though. If an individual is interested to try the walking meetings, at least the core features should be available for anyone.

High score list for grouped users

As some people enjoy competition there is also and high score list (Figure 25C) that is related to the organization/grouped users feature. People inside the same organization or group can see the other's weekly/monthly progress that is measure for example based on the collected points during week/month.

Not all people are interested or motivated by competition, so it should be optional to join the high score list. There are people who can actually be discouraged when there is competition involved, and it is not desirable result.

6.3 Summary

The overall application concept tries to consider all the most important results, needs and wishes we gathered during the research project. We learned a lot about our target group and context of use, and this concept aims to combine all the things that we learned and avoid the mistakes we made during the prototype phases.

All in all, the application ended up including more features that was originally anticipated and the implementation of the application with all features described above can take time and be challenging. As some of the features are more important for the core idea of walking meetings than others, the most important features should be decided and prioritized to be implemented first. The other features that are more optional for the core experience, could be implemented on the later phases of the process.

When thinking the other possibilities outside the smartphone context, the application concept could also include some kind of desktop version of the mobile app. If the application would be implemented web developing technologies, it would be possible to enable usage of the application also with web browser without too much additional work.

7. DISCUSSION AND CONCLUSIONS

This work revealed that designing a persuasive and motivational walking meeting application, or any other kind of application with similar goals, requires combining knowledge of multiple different fields. First, the designer should pay close attention to the needs and expectations of the target user groups and consider the context of use to build a basis for the overall design and user experience. To collect this knowledge, the designer should follow the Human-Centered Design Process, or some similar process, to gather information and design in iterative cycles. On more detailed level, the designer should understand the basic principles of motivation form psychological perspective and think about how the application can help users by persuasion on the right moments. On the technical level, the designer should know how people expect the application work and take a closer look to the user interface design guidelines and design the features to match users' mental models and platform specific guidelines as well as possible for the best user experience.

As the learning of new habit or way to do things requires repetition, the motivational and persuasive elements are the key when trying to provide aid to habit change. As people will be motivated by different things and they will have varying levels of motivations to change, also different types of motivational elements are needed in the application. On the top of motivation, repeating the new habit can be supported by providing users right kind of knowledge and tool in the manners of persuasion and persuasive design. For example, combining the new habit with a current habit that repeats as many times as the new habit is desired to happen, learning the new habit will become easier to do and remember to repeat.

To learn what are the right features, information and tools that knowledge workers need and expect from a persuasive walking meeting application, the three user studies were conducted. The studies also revealed many motivational aspects that could be included to the application design and they also answered the research questions set for this work. These answers also have the major part in guiding the final design of the persuasive walking meeting application with the support of knowledge from other related knowledge presented in this work.

The answer for the first research question *"What makes a walking meeting application different from other physical activity mobile applications?"* in summarized form can be divided in two answers. First, the work place as a context of use sets different requirements for the application motivational, persuasive and functionality features as off-work context. Also, the users expect different kind of features from the physical activity application in working environment than they would expect from an application they use in their free time. We also saw that the initial ideas, needs and expectations may not give good enough answers for the design and the iterative work is important part of the design process. This proves that working in close contact with the users is an important part of the design process and multiple user studies and tests are necessary to make a holistic design for any kind of purpose.

The second research question in this work is *"What kind of features and functionalities support and motivate users in a walking meeting application?"* and this question gives more hands-on answers about the actual design of the application. In short, the functionalities that are needed in work related persuasive walking meeting application are either features that support learning to use the walking meeting or support the actual work tasks or the features are related to motivation and persuasion to help users keep doing the walks. Some features are very similar to the physical activity applications that people use in their free time but we also realized that the interaction with the application at work is required to be different because people have other priorities when they are working. That also mean the support and motivation must be different in this context and the design and functionalities must be suitable for this kind of usage.

Overall the studies gave a good overall picture that there is a group of people who are interested to use walking meeting as a way of work. It was also clear that people felt that the walking has clear benefits both physical and mental level. On the other hand, combining the application as a part of the walk was proven to be more challenging than we expected, and not all users will want to or feel need to use the application. That is also one reason the point of the application will not be that the users would use it indefinitely but there should be minimum time they will use the application to kickstart the walking meetings and learn about it. The walking meetings on their own don't require the application but the studies showed that people had hard time with coming up with ways combining the walks as a part of their tasks and remembering to take the walks. And these are also the problem area that an application can give support to people. Learning to combine a new way of work and succeeding to follow a plan can give the feeling of competence and support the motivation.

On the practical level one thing that also can be challenging with the walking meeting application is that people are already using so many applications that they may not be interested to adopt new applications. But if they see there are other benefits that they gain from installing the application, for example that the employer gives them permission to take the walks if they use the applications, that also means they get more autonomy that is one of the strong motivational factors. That can work very well especially in the work places where there is not much freedom at the moment. On the other hand, using the application can also help people to find people who are alike through social features of the application. In many cases people are afraid to start something new if there is change they will be judged or they feel it is not acceptable to do things differently. This can enhance the feeling of relatedness and help motivate people.

As the application is designed just on the concept level and there is no actual functional version of the design it must be acknowledged that the application design is more of an example of how the features could be done in concrete level. To improve this, work the application should be implemented on some level and tested with real users. New user tests are needed because the design this time is different than we were able to do with our prototyping tool. Designing a stand-alone version of the walking meeting application is required to implement all the features the best way

possible. On the other hand, the guidelines in this work are on the stronger basis than the application concept design as they are based on three different user studies. If the work would be continued, the next step would be implementing the design and do new users tests and improve the design based on the results. The new studies would most likely also have some effect on the guidelines as they are closely related to the design.

Also, to improve the work further, the motivational theories should be covered more comprehensively and presented and compared different motivational theories. In this work only most appropriate motivational and persuasive work has been presented but the field offers much deeper knowledge about the topics that covered in this work. It would be also beneficial to combine persuasive design with gamification to support persuasive design further. To get more holistic picture of our walking meeting studies, a closer and deeper look into the study results would be needed as this work does not cover all the results from all the angles but only from the application perspective.

Overall changing work life more physically active and changing the way we perceive our working habits is an important topic. The improvement of working environments and the working habits is an ongoing discussion at the moment and many employees also compete by trying to offer their employees as good work conditions as possible. Even if there is a growing trend to have adjustable tables and different kinds of spaces for different kind of working needs, there is no good solution that would push us to actually move more during the working days. As it has been sown by other studies that we only must walk a little to start to feel the benefits, the walking meeting could help us to have at least a few more steps and more mental boost at work. When we walk, our thoughts seem to also run better, and that is something knowledge workers usually need when sitting in front of the computer.

Even if there it is not possible at the moment to implement the application concept, hopefully this work would give some fresh idea to other people who are interested in this topic and are passionate to improve our working life. The future work will require more user studies and tests but the very basics are there and they can be used in other project as well to compare with other study results outside of our studies.

REFERENCES

Apple .(2018). Developer Guidelines, Human Interface Guidelines. https://developer.apple.com/design/. (accessed on May 14th, 2018)

Ahtinen, A., Andrejeff, E., Vuolle, M. and Väänänen, K. (2016a). Walk as You Work: User Study and Design Implications for Mobile Walking Meetings. In *Proceedings of the 9th Nordic Conference on Human-Computer Interaction* (p. 72). ACM.

Ahtinen, A., Andrejeff, E. and Väänänen, K. (2016b). Brainwolk: a mobile technology mediated walking meeting concept for wellbeing and creativity at work. In *Proceedings of the 15th International Conference on Mobile and Ubiquitous Multimedia* (pp. 307-309). ACM.

Ahtinen, A., Andrejeff, E., Harris, C. and Väänänen, K. (2017). Let's walk at work: persuasion through the brainwolk walking meeting app. In *Proceedings of the 21st International Academic Mindtrek Conference* (pp. 73-82). ACM.

Baard, P.P., Deci, E.L. and Ryan, R.M. (2004). Intrinsic need satisfaction: A motivational basis of performance and well-being in two work settings. Journal of applied social psychology, 34(10), pp.2045-2068.

Braun, A., Schembri, I. and Frank, S. (2015). ExerSeat-Sensor-Supported Exercise System for Ergonomic Microbreaks. In Proceedings of the Ambient Intelligence, 236-251.

Cooper, A., Reimann, R., & Cronin, D. (2014). About face 4: the essentials of interaction design. John Wiley & Sons.

Fogg, B.J., 2002. Persuasive technology: using computers to change what we think and do. Ubiquity, 2002(December), p.5.

Fogg, B.J. (2009a) A behavior model for persuasive design. In Proceedings of the 4th international Conference on Persuasive Technology (p. 40). ACM.

Fogg, B.J. (2009b). Creating persuasive technologies: an eight-step design process. In Proceedings of the 4th International Conference on Persuasive Technology (Persuasive '09). ACM, New York, NY, USA, Article 44, 6 pages.

Fogg, B.J. (2018) BJ Fogg's behavior model. A behavior model for persuasive design URL: http://www.behaviormodel.org/ (accessed on May 14th, 2018)

Gong, J. and Tarasewich, P. (2004). Guidelines for handheld mobile device interface design. In Proceedings of DSI 2004 Annual Meeting (pp. 3751-3756).

Google. (2018) Material Design Guidelines. https://material.io/guidelines/ (accessed on May 14th, 2018.).

Hassenzahl, M., et al. 2000. Hedonic and ergonomic quality aspects determine a software's appeal. In Proceedings of the SIGCHI conference on Human Factors in Computing Systems, 201-208

Holtzblatt, K., & Beyer, H. (2015). Contextual design: evolved. Synthesis Lectures on Human-Centered Informatics, 7(4), 1-91.

Hu FB, Leitzmann MF, Stampfer MJ, Colditz GA, Willett WC, Rimm EB. Physical activity and television watching in relation to risk for type 2 diabetes mellitus in men. Arch Intern Med 2001;161(12):1542– 8.

Hu FB, Li TY, Colditz GA, Willett WC, Manson JE. Television watching and other sedentary behaviors in relation to risk of obesity and type 2 diabetes mellitus in women. JAMA 2003;289(14):1785–91.

Interaction Design Foundation. A Simple Introduction to Lean UX, https://www.interaction-design.org/literature/article/a-simple-introduction-to-lean-ux (accessed on April 25th, 2018)

ISO 9241-11:2017, https://www.iso.org/obp/ui/#iso:std:iso:9241:-11:ed-2:v1:en (accessed on April 25th, 2018)

ISO 9241-210:2010, https://www.iso.org/obp/ui/#iso:std:iso:9241:-210:ed-1:v1:en (accessed on April 25th, 2018)

Jans, M.P., Proper, K.I. and Hildebrandt, V.H. (2007). Sedentary behavior in Dutch workers: differencesbetween occupations and business sectors. Americanjournal of preventive medicine 33, 450-454.

Katzmarzyk, P. T., Church, T. S., Craig, C. L., & Bouchard, C. (2009). Sitting time and mortality from all causes, cardiovascular disease, and cancer. Medicine & Science in Sports & Exercise, 41(5), 998-1005.

Koepp, G.A., Manohar, C.U., McCrady-Spitzer, S.K. et al. (2013). Treadmill desks: A 1-year prospective trial, 705-711.

Lazar, J., Feng, J. H., & Hochheiser, H. (2017). Research methods in human-computer interaction. Morgan Kaufmann.

MacEwen, B.T., MacDonald, D.J. and Burr, J.F. (2015). A systematic review of standing and treadmill desks in the workplace. Preventive medicine 70, 50-58.

Nielsen, J., 1995. 10 usability heuristics for user interface design. Nielsen Norman Group, 1(1).

Norman, D.A. (2005). Human-centered design considered harmful. interactions, 12(4), pp.14-19.

Norman, D., 2013. The design of everyday things: Revised and expanded edition. Basic Books (AZ).

Oppezzo, M., & Schwartz, D. L. (2014). Give your ideas some legs: The positive effect of walking on creative thinking. Journal of experimental psychology: learning, memory, and cognition, 40(4), 1142.

Oulasvirta, A. (2011). Ihmisen ja tietokoneen vuorovaikutus. Helsinki: Gaudeamus Helsinki University Press.

Oulasvirta, A., Tamminen, S., Roto, V. and Kuorelahti, J., 2005, April. Interaction in 4-second bursts: the fragmented nature of attentional resources in mobile HCI. In Proceedings of the SIGCHI conference on Human factors in computing systems (pp. 919-928). ACM.

Oviatt, S. (1999). Ten myths of multimodal interaction. Communications of the ACM, 42(11), 74-81.

Rogers, Y., Sharp, H., Preece, J., 2011. Interaction design: beyond human-computer interaction. 3rd edition. 157-219.

Ryan, R.M. and Deci, E.L. (2000a). Intrinsic and extrinsic motivations: Classic definitions and new directions. Contemporary educational psychology, 25(1), pp.54-67.

Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American psychologist, 55(1), 68.

Self-Determination Theory. (2018). The overview of the Self-Determination theory and collection of the publications. http://selfdeterminationtheory.org/ (accessed on April 12th, 2018)

Screensiz.es. (2017). Mobile phone screen size chart. http://screensiz.es/phone (accessed on January 12th, 2018)

Shneiderman, B. (2010) Designing the User Interface - Strategies for Effective Human-Computer Interaction, Addison-Wesley.

Unsplash, (2018). Free photos website. https://unsplash.com/@tranmautritam (accessed on April 25th, 2018)

Wang, F., Orpana, H. M., Morrison, H., De Groh, M., Dai, S., & Luo, W. (2012). Long-term association between leisure-time physical activity and changes in happiness: analysis of the Prospective National Population Health Survey. American journal of epidemiology, 176(12), 1095-1100.

Wickson, F., Strand, R., & Kjølberg, K. L. (2015). The walkshop approach to science and technology ethics. Science and engineering ethics, 21(1), 241-264.

APPENDIX A: GROUP DISCUSSION QUESTIONS OF THE FIRST STUDY

1

What kind of routes you would like to walk? Indoors or outdoors?

Can you think any routes or part of the routes that could be suitable for the walking meetings on the campus?

Would you rather like to create your own routes or follow existing ones?

2

What kind of meetings you think the walking meetings are suitable for?

What long a walking meeting should take?

What is the suitable number of participants for a walking meeting?

3

Think about the next questions from the mobile application perspective:

What do you think: should a walking meeting include some of the following: playful elements, game like elements, surprises, competition, etc. Can you think example how?

Would you like to create some content for the walking meeting stops or along the route? What kind of content?

APPENDIX B: THE STRUCTURE AND QUESTIONS OF THE SECOND STUDY

Expectations before walking meeting:

- Filling in the background questionnaire
- Have you tried walking meetings or heard about them before?
- What kind of expectations you have?

During the walk (asked when it is appropriate):

The implementation, UI, usability:

- Usability? (Observe the usability problems)
- Easy to understand?
- Acceptability for the purpose?
- Metaphors? (Metro idea, lines, stops, conductor)
- Visual design?

Physical world and environment:

- How do you feel about implementation and functionality of the walking meeting stops?
- How about information on the stops?
- What do you think about the Mindfulness -stop?
- Thoughts about line names? Any suggestions?
- Is there enough stops?
- Are there enough lines?
- Are the lines long enough?
- Indoors or outdoors?
- Environment and the route where the walk takes the place?
- How about the printed metro map?
- What else Walking metro could include?

Concept idea:

- What do you think of the mobile application supported walking meetings?
- Is the concept usable? Is it useful?
- Good things in the concept?
- Negative sides? What should be changed or improved?
- Would you like to use this? Would you recommend this?
- For what kind of work tasks this is suitable for in your own work?

End interview?

Motivation and utilizing the application:

- How we could get people use the app?
- What would be good features for long term motivation?
- What do you think …
    - … about the guidance?
    - … about the surprising elements?
    - … about the game like elements?
    - … about the progress?

- … about the social elements?

Expected effects:

- How do you think the walking meetings will affect people who do them?

Questionnaire: AttrakDiff

APPENDIX C: PILOT STUDY WALKING DIARY MATERIAL

Date: _____ Time: _____ Number of participants: _____

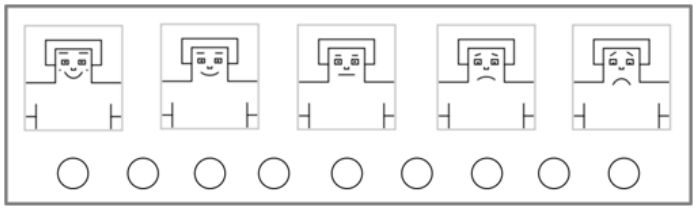
DIRECTIONS

1. Before you start the Brainwolk mark below with **number 1** how do you feel before the walk.
2. When you come back from the Brainwolk mark below with **number 2** how do you feel after walk

The direction of the feeling

POSITIVE

For example:
Happy
Cheerful

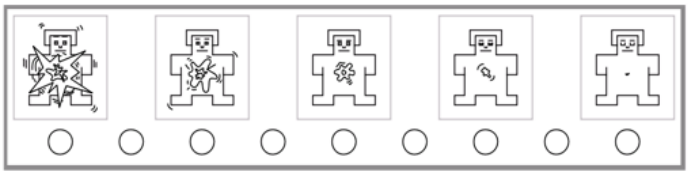


NEGATIVE

For example:
Angry
Frustrated

The magnitude of the feeling

Very strong



Very mild

Answer the questions after the Brainwolk:

Brainwolk had positive effect on...

	I disagree	I disagree more than I agree	I don't disagree or agree	I agree more than I disagree	I agree	I can't say
...creative thinking	○	○	○	○	○	○
... finding new perspectives	○	○	○	○	○	○
...vitality	○	○	○	○	○	○
...relaxation	○	○	○	○	○	○
...happiness	○	○	○	○	○	○
...interaction	○	○	○	○	○	○

Free thought about the Brainwolk: _____

_____

_____